9

ELEMENTS
OF
CHEMISTRY.
BEING THE
Annual Lectures
OF
HERMANN BOERHAAVE, M. D.

In Two VOLUMES.

Illuſtrated with ſeveral COPPER PLATES.

Engliſhed by a Gentleman of the Univerſity of Oxford.

NUMB. I.

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HERMANN BOERHAAVE

To his Brother

JAMES BOERHAAVE.

AS I could not any ways avoid publiſhing the Book I now addreſs to You, I was obliged in my old Age to review many of the Labours of my Youth, not without a ſort of Amazement, as often as I reflected on the Variety of the Operations, and the mighty and terrible Dangers that attended the Execution of them. I cannot but remember, and with great Pleaſure and Gratitude acknowledge the equal part You bore throughout this whole Exerciſe. Nor do I believe that You yourſelf can, but with ſome degree of Satisfaction, call to mind the many Days and Nights we ſpent together in a chemical Examination of Natural Bodies. You were at that time deſigned for Phyſick, and I for Divinity: But Providence would have it otherwiſe; and whilſt You attended at the Altars of the Deity, recommending his Precepts with a Simplicity of Speech and a Sanctity of Manners; I, unequal to ſo arduous a Task, contented myſelf to employ my weaker Talents in the healing Art. You have an undoubted Claim to the Work You had ſo large a Share in; and therefore I intreat You to accept it, as what I ſincerely intend, a publick Token, and a ſtanding Monument of brotherly Candour and Affection. I have ever eſteemed it my greateſt good Fortune, to have been bleſs'd in a Brother whoſe Principles and Actions have rendred him worthy of the great Office to which he was called, and whoſe only Ambition is to conciliate Men to God. Happy for me if I have ſo acquitted myſelf in my own Province, as not to have deſerved Your Cenſure! Adieu: And as often as a little Leiſure ſhall permit You to take this Book in hand, remember that after all the Toil we underwent together, we never once thought it tedious.

Leiden, 1731.

PREFACE TO THE READER.

IT never once entred into my mind, that I ſhould publiſh any thing of Chemiſtry: A ſubject handled by ſo many Authors, and by ſeveral of them too, in ſo maſterly a manner, that I can hardly preſume myſelf capable of improving it, or of ſaying any thing new about it. 'Tis true, the nature of my academical Office required that I ſhould give a ſett of anniverſary chemical Lectures; but to no other end than juſt to lay down the firſt Rudiments, and to exhibit ſome ſpecimens of Operations for the uſe of ſuch as were pleaſed to put themſelves under my direction. In this view, the order and ſimplicity which I therein affected might poſſibly be thought in ſome meaſure to anſwer my purpoſe: And indeed in theſe views I eſteemed my time not altogether miſemploy'd, if Chemiſtry might be thereby advantageouſly introduced among other academical Arts. When I had done my utmoſt to carry on the matter thus far, I thought I might ſtop here, and flatter'd myſelf that no more would be required or expected of me. But the thing I find happened quite otherwiſe: For through an ungrateful diſpoſition of ſome of my Auditors, and a boundleſs avarice of certain Bookſellers, who care not which way they can contrive to grow rich; the Profeſſion of Chemiſtry I muſt own has been render'd bitter to me. Under a ſham pretext of making an improvement in Arts, they have taken an audacious and illegal liberty of obtruding upon the world a ſet of chemical Inſtitutions and Experiments to which my name is affixt without either my privity or conſent. I ſhall decline, as too irkſome an employ, to point out the Falſities, Abſurdities and Barbariſms I am made to advance in every page. The preſent Age, as if it intended to tranſmit a ſpecimen of its unhappy Taſte to ſucceeding ones, ſo countenanced the Forgery, that this ſcandalous Production was hardly out of the Preſs, before it met with a crowd of Purchaſers and Admirers, no leſs to their detriment than their ſhame. With what indignation muſt I have ſeen ſuch a Book among my Audience, they at the ſame time expecting that what I delivered to them ſhould agree to a tittle with the Trumpery they had in their hands! I applied myſelf for redreſs to thoſe who have a Right and Authority to reſtrain and puniſh ſuch Offences; nor had I failed of obtaining what I deſired, if ſome perſons, from whom I am ſure I deſerve quite another ſort of treatment, had not been pleaſed, not only to have the conſideration of my Petition poſtponed, but alſo to oppoſe it, altho' they had often given me ſuch aſſurances of their intereſts as would have deceived the moſt prudent perſon in the univerſe. I was convinced by this trial, that there are a ſett of people who feel an infinite ſatisfaction, if they can at any rate triumph over Men of Learning. Theſe, with ſome other reaſons, made me reſolve to teach Chemiſtry no longer; ſo I immediately quitted the Profeſſorſhip, and retired. I had ſcarce done this, but my quiet was interrupted again. My Friends were of opinion that I ought to publiſh my chemical Inſtitutions and Demonſtrations; that it might appear what my method of teaching Chemiſtry was, as well in publick as in private. 'Twas to no purpoſe I urged, that theſe domeſtic Inſtitutions were intended only for beginners, to acquaint them with the Hiſtory and Method of Chemiſtry, and ſo would be of no uſe to the Publick. Nay that they muſt be really tedious to any one tolerably vers'd in Chemiſtry, as they were only ſerviceable to the initiating of Novices, and carried no other kind of merit along with them. They inſiſted on it, that the ſpurious Work every where met with applauſe, that 'twas diligently enquired after, and bore a great price, and that without my prevention 'twould be ſoon reprinted. 'Twas then that with anguiſh I called *Petrarch* to mind, who lamented the misfortunes of the Age he lived in, when he underſtood that his own Poems were in ſuch eſteem as to appear in company with thoſe of the moſt celebrated Poets. More, thought I, would it become me to bluſh, when convinced of my own inſufficiency, I pay adoration to other Authors, and ſhould have yet the Preſumption to appear among the Writers of Chemiſtry. I acted upon compulſion when I undertook the irkſome Taſk, and I openly declare, that the Work with which I now incumber the Publick was, in truth, extorted from me. I have penn'd it in a ſtile the moſt conciſe I could, and have carefully avoided technical Terms. That this was far from an impoſſibility I was convinced from that immortal Work of Foſſils, Metals, and ſubterraneous Subſtances, written by the incomparable *George Agricola.* O that I were maſter of the leiſure requiſite for the imitation of ſo noble an Author! My Reader is not to expect that in this voluminous

Work he ſhall every where meet with a *Roman* purity of Language: And if I ſeem to dwell too long upon ſome minute circumſtances, he may be pleaſed to know, that in ſo doing, I am laying down the neceſſary precautions for avoiding the dangers which ſo frequently ariſe in this ſort of Operations. I have Novices in view, and therefore it behoves me to point out to them all that is hazardous and pernicious. And for this reaſon I proceed in the way of particular Experiments, being very cautious of laying down univerſal Rules. I would therefore adviſe young perſons to advance forwards in this laborious, but true path, which will certainly conduct them to the right knowledge of Nature. As I could not help inſerting in the firſt Part, the things which I had read ſeparately and at different times in publick upon chemical ſubjects, being deſirous of delivering them in the moſt free manner, and of illuſtrating them with ſomething additional, it has ſo fallen out, that I ſometimes repeat what has been mentioned before; nor could I well help it. Thus has the Book ſwell'd upon the hands of one who really has many occaſions of another ſort, to take up all his time. How often have I pronounced ſuch Authors happy, who have leiſure enough to contrive, digeſt, and give the laſt Poliſhment to the Work they would undertake! I was conſtrain'd to write this abruptly, and with thouſands of interpolations. It had been quite another thing if I could have carried it on in a proper retirement and with a due deliberation; my deſign leading me to confirm ſome, and further illuſtrate other matters by new Experiments; for I exhibited the Experiments that will be found here, a great many years ago in publick; which I take occaſion to obſerve, that they may not be ſuppoſed to have been borrow'd from any other Writer, without mentioning his name. And now I intreat my Reader to receive what I offer him with candour, and pardon me for thus incommoding him. Let him aſcribe the preſumption of this Edition to the eagerneſs with which the Publick was pleaſed to receive a far worſe Book. And let him be informed that I never printed any thing beſides, but what is contained in the following Liſt, which indeed I ſhould hardly name without a bluſh.

Oratio de commendando Studio Hippocratico. Spoken and printed at *Leiden* 1701, for *Abrah, Elſevier.*

——— *de Uſu Ratiocinii Mechanici in Medicina.* 1703, for *John Verbeſſel.*

——— *qua repurgatæ Medicinæ facilis aſſeritur ſimplicitas.* 1709, for *John vander Linden.*

——— *de comparando certo in Phyſicis.* 1715, for *Peter vander Aa.*

Oratio de Chemia ſuos errores expurgante. 1718, for *Peter vander Aa.*

——— *de Vita & Obitu Clariſſimi Bernardi Albini.* 1721, for *Peter vander Aa.*

An Oration which I ſpoke when I publickly reſigned the Profeſſorſhip of Botany and Chemiſtry. 1729, for *Iſaac Severinus.*

——— *de Honore Medici, Servitute.* 1731, for *Iſaac Severinus.*

Inſtitutiones Medicæ in uſus annuæ exercitationis domeſticos. 1708, for *John vander Linden.*

This was ſeveral times reprinted with additions in 8°.

Aphoriſmi de cognoſcendis & curandis Morbis in uſum doctrinæ domeſticæ. 1709, for *John vander Linden.*

This was ſeveral times reprinted with additions.

Index Plantarum, quæ in Horto Academico Lugduno-Batavo reperiuntur. 1710, for *Cornelius Bouteſtein.*

Materia Medica & Remediorum Formulæ. 1719, for *Iſaac Severinus.* 8°.

This was reprinted in 8°.

Index alter Plantarum quæ in Horto Academico Lugduno-Batavo aluntur. 1720, for *Peter vander Aa.*

Atrocis nec deſcripti prius, Morbi Hiſtoria, ſecundum Medicæ Artis leges conſcripta. 1724, for *Bouteſtein.* 8°.

Atrocis rariſſimique Morbi Hiſtoria altera. 1728, for *Samuel Luchtmans,* and *Theodore Haak.* 8°.

A medicinal Tract on the Venereal Diſeaſe, prefixt to the *Aphrodiſiacus.* 1728, for *Joh. Arn. Langerate,* and *Joh.* and *Herm. Verbeck.* Folio.

Epiſtola pro Sententia Malpighiana de Glandulis ad Cl. Ruiſchium. 4°. for *Peter vander Aa.*

All other things that are printed in my name, except a few Prefaces, are ſpurious, and I utterly diſown them.

THE

DESIGN.

GENTLEMEN,

The Deſign.

AS you have been pleas'd to put your ſelves under my direction in the affair of learning Chemiſtry, I ſhall on my part endeavour in the moſt advantageous manner I can, to promote your deſign.

And that I may prove ſucceſsful in ſuch an undertaking, I ſhall obſerve a perſpicuity and order in explaining to you whatſoever is neceſſary to a due underſtanding of the beſt Authors that have written concerning this Art; from reading which, and adhering ſolely to Experiments, not only the diſciplinary part thereof may be attained, but the uſual operations well underſtood and conducted; ſo that both the head and the hand will acquire an aptneſs requiſite for the purpoſe.

Difficulty of the Deſign.

This may be judged a matter of no ſmall difficulty to effect in an Art which has been cultivated by perſons who attained it rather fortuitouſly, than by purſuing any rules of diſcipline, or calling in the aſſiſtance of a liberal education.

Their manner of writing about it was no other than penning down a number of facts, without method or order, but juſt as they happened to offer themſelves.

And what has rendered the misfortune ſtill greater, was a perpetual neglect of noticing thoſe things of which they had a familiar knowledge; altho' the recital of them were eſſentially neceſſary to initiate the ignorant reader in the knowledge of natural cauſes.

But this Science arrived at the greateſt degree of difficulty when theſe Artificers took upon them to treat it in the argumentative way, to lay down Generals, and account for the cauſes of *Phænomena*.

Method of the Inſtitution.

Yet are theſe difficulties to be removed by collecting together the real facts that occur in the exerciſe of the Art, and deducing general rules therefrom, and finally by digeſting theſe in a proper and regular manner.

If more eſpecially the perſon who undertakes ſuch a province, be himſelf well ſkilled in the operative part of the Art, and joins to it a right manner of thinking; in which matter I will not deny but I have been ſomewhat converſant.

Diſtribution of the Work: Part the firſt.

Wherefore it is not without a moderate confidence that I enter upon theſe Inſtitutions, purpoſing to divide the whole Work into three parts.

The firſt ſhall exhibit the origin, progreſs, culture and fate of the Art; with an hiſtorical liſt of the chief Authors that have wrote about it, in order of time: It ſhall briefly ſhew wherein they conſent and differ; and the ſeveral ſects of them, with the good or harm they have done the Art, attributing to each the glory due to his merit, whilſt it beſtows applauſe upon what is uſeful to mankind, and lays down proper cautions for conducting the ſteps in the diſciplinary part. And herein the laws of Hiſtory are ſtrictly adhered to.

Part the ſecond.

The ſecond part of my Inſtitutions ſhall give certain and ſolid *dogmata* in Chemiſtry, containing all the phyſical truths that the Chemiſts have diſcovered. Theſe are general, and exhibit the artificial way of performing rightly the operations which may and ought to be performed in the Art of Chemiſtry.

We admit no Theory in this Art, but ſuch as is built on general Propoſitions: Which Propoſitions themſelves muſt be firſt of all deduced from a number of common and ſolid chemical Obſervations, offering themſelves conſtantly in the ſame manner, ſo that one general truth may be juſtly collected from them.

Its limits,

Yet muſt not even this Rule be extended a jot further, than where it is applicable to ſuch particulars as come under one and the ſame conſideration.

And the reaſon of it.

Namely, when bodies by their proper powers do produce ſuch effects as fall not under any general Theorem; ſince they reſult from a particular diſpoſition of ſuch particular bodies, and which perhaps no other body has in common with them.

The Uſefulneſs of Mathematics and Phyſics in Chemiſtry.

In conſtructing this Theory, there is allowed a prudent uſe of the ſeveral things that have been demonſtrated in Phyſics, Mechanics, Hydroſtatics, and Hydraulics; ſince the properties which are common to all bodies, and all that depends upon them muſt undoubtedly take place in Chemiſtry. I ſay a prudent uſe of them is allowed, in this compound manner; becauſe the proper diſpoſition of a particular body applied to another body is oftentimes contradictory to what has been demonſtrated in Mechanics of bodies in general. *Galilæo* demonſtrates very finely, with what law a heavy body, if let fall, from the point of its firſt deſcent, by a ſpiral, or elliptical line, and with a certain degree of acceleration, falls on a point of the earth which was in the line drawn perpendicular to the horizon from that point where the deſcent was begun, at that moment of time. Yet if a loadſtone ſo falling ſhould in its progreſs enter the ſphere of activity of another ſuſpended loadſtone, the Demonſtration would preſently appear falſe. The things which *Archimedes* has laid down with ſo much truth concerning bodies that equiponderate in water, come to nothing, becauſe gold which ſinks in every other liquid, is kept ſuſpended in ſo light a one as *aqua regia.*

So that with the aforementioned reſtriction, whatſoever is found to be true in Phyſics, or thoſe other Sciences named with it, will always be ſerviceable, and can never be detrimental to the Art.

The laſt part of the Deſign.

The third part of the Deſign will be compleated in actually exhibiting to the view the chemical artifices employed in the ſeveral Operations, by which bodies are changed, according to the precepts of the Art, and for the end which the Art itſelf alſo deſigned them.

It ſhall be my care to diſpoſe theſe in ſuch order, that the moſt vulgar matters ſhall not eſcape your notice; nothing ſhall be fruitleſly repeated; but whatſoever is neceſſary to the duly carrying on a ſubſequent Experiment, ſhall be premis'd in a former.

The Order in which the chemical Experiments are digeſted.

In this exerciſe all the Theorems explained in the ſecond part, will come immediately into uſe; and from them all the Operations will be eaſily accounted for, and the head and hands will be directed faithfully in the Practice of the Art. Moreover any particular Operation will be a demonſtrative example of the particulars from whence the general Theorem was conſtructed. This, Gentlemen, is the right way to arrive at the perfection of the Science of Chemiſtry. Such an inſtitutional method of proceeding, tho' painful enough in itſelf, ſaves a great deal of pains; whereas the labours of the Chemiſts, which they call Proceſſes, with all their mighty buſtle, effect no more, than miſpending time and impoveriſhing inſtead of benefiting thoſe who have a fondneſs for them.

Uſe of the Theory of Chemiſtry in the Experiments.

COLLEGIUM CHEMICUM.

PART I.

OF THE

Hiſtory of Chemiſtry.

Of the Nature of the Art.

THE *Greek* from which this Art takes the name of *Chemia*, or *Chemiſtry*, is Χημία, or Χημεία; a word ſo very old, as to be ſuppoſed to have been in uſe in the ante-diluvian world.

Such was the Opinion of *Zoſimus* the *Panopolitan*, ſeveral of whoſe *Greek* manuſcripts, which *Georgius Agricola* had ſeen before the year 1550, are ſtill preſerved in the King of *France*'s Library, and were peruſed by *Joſeph Scaliger* and *Olaus Borrichius*.

In one of theſe books, entitled χρῆσις Ζωσίμου τοῦ πανοπολίτου φιλοσόφου ἐκ τῆς πρὸς Θεοσέβειαν ἐν τῷ θ τῆς Ἰμοὺθ βίβλῳ; he expreſly informs us, that Chemiſtry was the Art which was communicated by Dæmons to the daughters of men, in lieu of certain favours they had obtained of them, (χημίαν καλεῖσθαι) as *Scaliger* reads it in the Notes on the *Greek* of *Euſebius* pag. 243, 258. N. 38. and *Borrichius* againſt *Conringius*. pag. 49. φάσκουσιν αἱ ἱεραὶ γραφαὶ, ἤτοι βίβλοι, ὦ γύναι, ὅτι ἔστι τι δαιμόνων γένος, ὃ χρῆται γυναιξίν. ἐμνημόνευσε καὶ ἑρμῆς ἐν τοῖς φυσικοῖς, καὶ σχεδὸν ἅπας λόγος φανερὸς, καὶ ἀπόκρυφος τοῦτο ἐμνημόνευσεν. τοῦτο οὖν ἔφασεν αἱ ἀρχαῖαι, καὶ θεῖαι γραφαὶ, ὅτι ἄγγελοι ἐπεθύμησαν τῶν γυναικῶν, καὶ καθελθόντες ἐδίδαξεν αὐτὰς τὰ τῆς φύσεως πάντα τὰ ἔργα. ἐστὶν οὖν αὐτῶν ἡ πρώτη παράδοσις ΧΗΜΑ͂ περὶ τούτων τῶν τέχνων. ἐκάλεσαν δὲ ταύτην τὴν βίβλον ΧΗΜΑ͂. ἔνθεν καὶ ἡ τέχνη ΧΗΜΙ'Α καλεῖται.

Now this very ancient conceit aroſe from a miſinterpretation of the words of *Moſes* (*Gen.* vi. 2.) from which it was ſuppoſed that the ſons of GOD were Dæmons, having indeed real ſouls, but whoſe bodies were no more than mere phantoms, like the images of a looking-glaſs, that they were perfect in all kinds of knowledge, that they converſed with men, and were enamour'd of women, and did enjoy them, that they revealed ſecrets, and appeared to men. On this matter conſult *Luke* xxiv. 37, 39. *Matth.* xiv. 26. Nor ſhould it ſeem unnatural to refer to this origin the matter of Σίβυλλα, Σιοῦ i. e. Διοῦ βύλλα in the Æolic Dialect, or βουλή. On which Lady *Phœbus* conferred the gift of Divination, and revealed to her the will and ſecrets of Heaven, as an equivalent for the laſt favour. So apt are men to erect idols in their fancy, and then adore them!

Moreover *Egypt* itſelf was very anciently called by the ſame name; for which we have the authority of *Plutarch (in IS. & OS. pag. 364. C.)* ἔτι τὴν αἴγυπτον ἐν τοῖς μάλιστα μελάγγειον οὖσαν, ὥσπερ τὸ μέλαν τοῦ ὀφθαλμοῦ, ΧΗΜΙ'Α καλοῦσι. It was called alſo by another name, ἑρμοχήμιος, as *Steph. Byzant.* has obſerved in the word αἴγυπτος. Now *Bochart* tells us, that χημᾶ, amongſt the *Arabians*, ſignifies *to hide.*

It is very ancient.

Upon a thorough conſideration of all theſe particulars, one may eaſily perceive, that the name was ante-diluvian, that it continued in uſe in after-times, and did then ſignify,

1. The Knowledge of the works of nature. διδασκαλίαν πάντων τῶν τῆς φύσεως ἔργων.
2. The Book containing the Tradition of ſuch an Art.

Signification of its moſt ancient Name.

And it is obſervable, that *Hermes* in his book of Phyſics, made mention of the very thing itſelf.

If the word be wrote χημᾶ, it ſignifies, according to *Bochart*, *to hide*, as I obſerved juſt now. But if χημία ſignifies the black of the Eye, or ſomething intenſely black, according to *Plutarch (IS. & OS. pag. 364. C.)* then according to the humour of the hieroglyphical Writers, it ſhould ſignify ſomething like occult; for with them by the pupil of the Eye was always meant a thing concealed and rare.

What may ſerve greatly to confirm this, is, that *Egypt*, the land of *Cham* mention'd in holy Writ (*Pſalm* cv.) called their God Ἀμοῦν, which *Manetho* the *Sabennite* (*Plutar. IS. & OS. pag.* 554.) will have to ſignify τὸ κεκρυμμένον.

Moreover that very Country is at this day called *Cemi Coptitis*, as the ſame *Samuel Bochart* aſſures us.

Wherefore the word muſt ſignify occult, concealed, myſterious, ſecret; and it is called *Chemi*, *Chemia*, *Alchemia*, *Alkumia*, χημᾶ, χημία, Ἰμοὺθ, ποιητική, the Spagiric and Hyſſopic Art, ſeparating the pure from the impure.

The word, in the Authors that firſt made uſe of it, ſignified the whole Knowledge of natural things.

So that the pure and genuine ſignification of it was afterwards ſadly wreſted; and the word Magic, among the unlearned, met with the ſame misfortune.

Now Metals conſtituting a very conſiderable and extraordinary part of the natural things before mentioned, it came on that ſcore to ſignify Metallurgy, an Art greatly cultivated by the Ante-diluvians: For *Tubal-cain*, the true *Vulcan* of the Ancients, who was the Son of *Lamech* and *Zillah*, and the eighth from *Adam*, underſtood the ordering of braſs and iron ſo as to make utenſils of them. (*Geneſ.* iv. 22.)

How it came to ſignify Metallurgy.

Yet it is a matter of ſo great ſkill and difficulty to make copper fit for uſe, from its oar, that it takes a dozen fuſions to render it requiſitely malleable, as *Agricola* and *Erker* aſſure us.

The Difficulty of Metallurgy.

Iron likewiſe demands a thorough ſkill, beſides a great deal of labour, before it will be fit for any uſeful purpoſes, as the ſame moſt expert, and faithful Præceptors of this Art have obſerved.

So that the moſt ancient origin of the oldeſt metallurgic Chemiſtry, as well as that of the word itſelf, is perfectly underſtood.

Metallurgic Chemiſtry firſt cultivated in *Aſia.*

The Country where Metallurgy was firſt laudably cultivated, was that which was inhabited by the firſt men, which the Hiſtory of *Tubal-cain* confirms, (*Gen.* iv. 22.) eſpecially if we compare it with the Fables and Hiſtories of the ancient *Vulcan*, who was the ſame with *Tubal-cain* (*Voſſ. Id. g.* 1. 65.) Add to this, that the very Name of the Art, in its original meaning, ſeems to prove the thing, as was ſhew'd you before.

Then into *Egypt.*

Then, like other Arts, it paſſed into *Egypt*, where it was moſt vigorouſly proſecuted: *Moſes*, a man thoroughly vers'd in all the wiſdom of the *Egyptians* (*Act. Apoſt.* vii. 21.) knew how by fire to reduce gold to ſuch a powder as would mix with water, and become potable, (*Exod.* xxxii. 20.) a moſt notable inſtance of ſkill, and which ſurpaſſes any thing that can be boaſted of at this time of day! *Vulcan* the ſon of *Jupiter* and *Juno*, was the firſt King that reigned in *Egypt*, and after his death he was deified for being the Inventor of fire, (*Diodor. Sic.* L.) or more probably for firſt applying fire to the working of metals, as the ſame *Diodorus* expreſly ſets forth (*γ*) Ἥφαιςον δὲ λέγουσιν εὑρετὴν γένεσθαι τῆς περὶ τὸν σίδηρον ἐργασίας ἁπάσης, καὶ τῆς περὶ τὸν χαλκὸν, καὶ χρυσὸν, καὶ ἄργυρον, καὶ τῶν ἄλλων, ὅσα τῶν ἐκ τοῦ πυρὸς ἐργασίαν ἐπιδέχεται. καὶ τὰς ἄλλας ἢ χρείας, τὰς τοῦ πυρὸς ἅπασας προσεξευρεῖν, καὶ παραδοῦναι τοῖς τε τὰς τέχνας ἐργαζομένοις, καὶ τοῖς ἄλλοις ἅπασιν ἀνθρώποις.

But *Egypt*, in the ſacred Dialect of the Prieſts, is called Χημία (*Plutarch. IS. & OS.* 364. *C.*) and ἑρμοχήμιος (*Steph. Byzant.* in the word αἴγυπτος.)

It is alſo called Ἡφαιςία, or *Vulcania* (*id. ibid.*) 'Tis true the great *Scaliger* aſſerts, that the Art χημία was by the *Egyptians* called Ἰμοὺθ. And yet in the book called *Minerva Mundi*, as tranſcribed from *Stobæus*, it is, ποιητικῆς τὸν Ἀσκλήπιον τὸν Ἰμούθης (*Conring. h. m. c.* 111.) now ποιητικὴ is Chemiſtry. (*Reineſ. var. lect. L.* 11. *c.* 5.)

It is certain that *Vulcan* had Prieſts at *Memphis* [*Herodot.* 11. 3.) a pompous Temple was alſo erected to him there (*Id.* 11. 99.) with portico's (*Id. ib.* 102.) and images (*Id. ib.* 176. III. 37.) and his ſymbol there was a vulture (*Voſſ. id. g.* III. 573.) that is a bird of prey. Moreover *Zeno* ſays, and explains it, τὸν Δία Ἥφαιςον καλεῖσθαι κατὰ τὴν διάτασιν εἰς τὸ τεχνικὸν πῦρ (*Diog. Laert.* vii. 147.) the name originally ſignifying παρὰ τὸ ἧφθαι to be kindled up, or to burn: In alluſion to which *Horace*, that maſterly coiner of Epithets, has it,

——— *dum gravis Cyclopum.*
Volcanus ardens urit officinas.

(*Carm.* 1, 4, 7.) and *Plautus* (*Amphytr.* 1. 1. 185.) had before the ſame thought.

Quo ambulas tu, qui Vulcanum in cornu concluſum geris?

All theſe particulars ſeem to evince, that this part of Chemiſtry, called Metallurgy, was much in practice among the ancient *Egyptians*, nor is there, I think, any room to doubt concerning the Antiquity of the old Art, in this ſenſe, or of the meaning of the word itſelf.

Origin of the word applied to the Art of making Gold.

A long while afterwards, the word begun to bear the ſignification of making the pureſt gold out of any metals, whether by real tranſmutation, maturation, or ſome particular ſeparation unknown to the vulgar.

In proceſs of time the *Arabians*, who became principal cultivators of this ſort of Knowledge, changing a little the ſound, but retaining the meaning, called it Alchemy, and likewiſe Alchimy.

Very uncertain.

Suidas, who lived in the tenth Century, (*under the word* Χημεία) writes that *Diocleſian*, who reigned the twenty laſt years of the third Century from the birth of *Chriſt*, commanded that all the books which treated of this Art, ſhould be burnt, on account of ſome deſigns which the *Egyptians* were carrying on againſt the *Roman* Empire. χημεία, ἡ τοῦ ἀργύρου, καὶ χρυσοῦ κατασκευή. ἧς τὰ βιβλία διερευνησάμενος ὁ Διοκλητιανὸς ἔκαυσε, διὰ τὰ νεωτερισθέντα Αἰγυπτίοις Διωκλητιανῷ. τούτοις ἀνημέρως, καὶ φονικῶς ἐχρήσατο. ὅτε δὴ καὶ τὰ περὶ χημείας χρυσοῦ, καὶ ἀργύρου τοῖς παλαιοῖς γεγραμμένα βιβλία διερευνησάμενος, ἔκαυσε πρὸς τὸ μηκέτι πλοῦτον Αἰγυπτίοις ἐκ τῆς τοιαύτης προσγίνεσθαι τέχνης, μὴ δὲ χρημάτων αὐτοὺς θαῤῥοῦντας περιουσίᾳ, τοῦ λοιποῦ Ῥωμαίοις ἀνταίρειν.

And under the word δέρας he ſpeaks more home, and makes no ſcruple to aſſert very magiſterially, and expreſly, τὸ χρυσόμαλον δέρας, ὅπερ ὁ Ἰάσων διὰ τῆς ποντικῆς θαλάσσης σὺν τοῖς Ἀργοναύταις εἰς τὴν Κολχίδα παραγενόμενοι ἔλαβον, βιβλίον ἦν ἐν δέρμασι γεγραμμένον, περιέχον ὅπως δεῖ γίνεσθαι διὰ χημείας χρυσόν. Which, were it confirmed by proper vouchers, would carry the Science back to thirteen Centuries before *Chriſt*, that is, before the time of the *Argonauts*. And yet an Art known, practis'd, and laid down in writing, was, it ſeems, the motive of a perilous and toilſome expedition to the *Argonauts* themſelves. Is it not a matter of amazement, that *Moſes*, the holy Scriptures, *Sanconiatho*, *Orpheus*, *Homer*, *Heſiod*, *Pindar*, *Herodotus*, *Thucydides*, *Hippocrates*, *Ariſtotle*, *Theophraſtus*, *Dioſcorides*, *Galen*, and *Pliny* ſhould be wholly ſilent upon this point, when it appears to any one who is acquainted with their Writings, how much their ſeveral ſcopes, ſubjects, faculties and ages did require the mention of it?

Neither that paſſage of *Pliny* about flexible Glaſs (XXXV. 25.) nor that of *Dion Caſſius*, which mentions *Tiberius*'s rejecting ſuch a propoſal (LVII. *pag.* 617.) nor another of *Pliny* concerning *Caligula*'s ſeparating an exceeding ſmall quantity of pure gold from a very large parcel of orpiment (XXXIII. 4.) do make any thing to the purpoſe, ſince they ſerve to prove no more, than that the Art of Glaſs, and the docimaſtic Art were known in thoſe days.

Yet ancient and uſed by the *Greek* Divines.

It muſt be owned indeed, that *Julius Maternus Firmicus* did in the beginning of the fourth Century, write a book of the Science of Alchimy, as of a thing well known, provided that work be genuine.

And *Æneas Gazæus*, towards the cloſe of the fifth Century, in his *Theophraſtus* or treatiſe of the Immortality of the Soul, ſpeaking of this Art, deſcribes it as a thing publickly known; adding, that thoſe who are well acquainted with this matter, can take ſilver, and tin, and diveſting them of their former nature, change them into the pureſt gold, *Biblioth. Patr. vol.* 2. *pag.* 373.

Clarius Anaſtaſius the *Sinaïte* about fifty years later, as *Voſſius* thinks, but more juſtly about the middle of the ſeventh Century, as *Fabricius* has judiciouſly fixt it (*Biblioth. gr. v. pag.* 313.) writes; οὐ γὰρ δὴ χρυσοχόους ἡμᾶς, καὶ λιθουργοὺς, καὶ χημευτὰς, χρυσοκολλήτων λίθων ἀπεργάζεσθαι, ἡ γραφὴ βουλομένη, καὶ παιδεύουσα ταῦτα φησίν.

Laſtly in the ſeventh Century *Georgius Syncellus* handled the ſubject in a very laborious manner.

The *Greek* Chriſtians the principal writers of Alchemy. Whether the firſt. A Catalogue of them.

Immediately afterwards ſprung up a crowd of writers of Alchemy, whoſe manuſcript Works, penn'd in a kind of theological ſtyle, are preſerved at *Rome*, *Venice*, and *Paris*. *Borrichius* has given a Catalogue of thoſe that were never printed (*de Hermetis, Ægyptiorum, & Chemicorum Sapientia, pag.* 78.)

Συνέσιος, whoſe treatiſe of the Philoſophers Stone is in the Library of the Univerſity of *Leiden.*

Συνέσιος φιλόσοφος εἰς βιβλίον Δημοκρίτου. The whole treatiſe is in *Fabric. Bibl. Gr.* L. v. *cap.* 22. *p.* 232. *Gr. & Lat.*

Σώσιμος ὁ μέγας, ὁ θεῖος, ὁ Πανοπολίτης, of πανάπολις a city of *Egypt.* XXIV. books of Ἰμοὺθ to Θεοσέβεια. The title is Σωσίμου τοῦ πανοπολίτου γνησία γραφὴ, περὶ τῆς ἱερᾶς, καὶ θείας τέχνης τοῦ χρύσου, καὶ ἀργυρίου ποιήσιος: and Ζώσιμος περὶ ὀργάνων, καὶ καμίνων.

Ὀλυμπιόδωρος ὁ Ἀλεξάνδρινος.

Ἡλιόδωρος περὶ χρυσοποιήσιος.

Ἰωάννης Ἀρχιερεὺς, τοῦ ἐν ἁγίᾳ πόλει περὶ τῆς ἁγίας τέχνης.

Στέφανος ὁ φιλόσοφος ἀλεξανδρεὺς οἰκονομικὸς περὶ τῆς ἱερᾶς, καὶ θείας τέχνης τοῦ χρυσοῦ ποιήσιος. The Manuſcript of this is alſo in the Library of the Univerſity of *Leiden.*

Ὧρος. χημευτικά.

Σοφὰρ ἐν περσίδι.

Ἕρμης compoſed in the ſixth Century, and commended by *Zoſimus.*

Διόσκουρος ὁ ἱερεὺς μεγάλου Σεραπίδος ἐν ἀλεξανδρείᾳ.

Ὀσάνης ἀπ' Αἰγύπτου πρὸς Πετάσιον περὶ τῆς ἱερᾶς καὶ θείας τέχνης.

Μώσης προφήτης περὶ χημευτικῆς συντάξιος.

Μαρία Ἑβραῖα.

Πελάγιος φιλόσοφος περὶ τὴς θείας, καὶ ἱερᾶς τέχνης.

Πορφύριος.

Ἐπιβύχιος. or Ἐπιβήχιος.

Κομάριος φιλόσοφος, καὶ ἀρχιερεὺς, διδάσκων τὴν Κλεοπάτραν τὴν θεῖαν καὶ ἱερὰν τεχνὴν τοῦ λίθου τῆς φιλοσοφίας.

Κλεοπάτρα ἡ γυνὴ Πτολεμαίου τοῦ βασιλέως. The ſame περὶ σταθμῶν καὶ μέτρων.

Κοσμᾶ ἱερομονάχου ἑρμηνεία τῆς χρυσοποΐας.

Ἀγαθοδαίμων εἰς τὸν χρησιμὸν Ὀρφέως συναγωγὴ, καὶ ὑπόμνημα.

Πάππου φιλοσόφου ἔργον.

Ἡράκλειος ὁ βασιλεύς.

Σαλμανᾶ Ἄραβος μέθοδος.

Χριστίανος περὶ τοῦ θείου ὕδατος.

Θεόφραστος φιλόσοφος περὶ τῆς θείας τέχνης.

Ἀρχέλαος φιλόσοφος περὶ τῆς θείας τέχνης.

Κλαυδίανος.

Σέργιος.

Ἀνεπίγραφος φιλόσοφος περὶ χημείας.

Μιχαὴλ Ψέλλος περὶ χρυσοποΐας. He lived in the time of one of the *Conſtantines* in the year of *Chriſt* 1060. *Borrich.* 79.

Ἶσις προφῆτις τῷ υἱῷ ὥρῳ.
Βλεμμίδας ἔργον χημευτικόν.
Νικέφορος.
Δημοκρίτου βίβλος προφωνηθεῖσα λευκίππῳ.
Δημόκριτος φυσικὰ καὶ μυστικά.
Ἱερόθεος φιλόσοφος περὶ λίθου τῶν φιλοσόφων.
Ἴσαακ Μόναχος, ὅπως δεῖ εὑρίσκειν μεθοδὸν ἀργύρου.

Concerning theſe *Greek* Writers of Alchemy conſult *Libavius*'s Works, eſpecially what he alledges againſt *Guibertus. Conring. de Med. Herm. pag.* 21, to 31. *Borrich. Ort. Ch.* 97. and againſt *Conring.* from pag. 66, to 95. *Joann. Albert. Fabric. Biblioth. gr.* throughout. And the Catalogue of the Library of the Univerſity of *Leiden.*

Who can be informed without amazement, that theſe Authors were known to *Georgius Agricola?* That incomparable Man wrote ſeveral excellent books about Metals, all which he finiſhed before the year 1550. *Eraſmus* ſpeaks of them with the greateſt applauſe. In the elegant Preface to theſe Treatiſes he gives a liſt of them all, much in the ſame order that I have done; in manifeſtation of which I entreat your patience for the recital of his own words. Χυμευτικὰ *ſcripſit, Oſthanes, Hermes, Chanes, Zoſimus Alexandrinus ad ſororem Theoſebiam, Olympiodorus item Alexandrinus, Agathodæmon, Democritus, non Abderites ille, ſed alius neſcio qui, Orus Chryſorichites, Pebichius, Comerius, Joannes, Appuleius, Petaſius, Pelagius, Africanus, Theophilus, Syneſius, Stephanus ad Heraclium Cæſarem, Heliodorus ad Theodoſium, Geberus, Calides Rachaidibus, Veradianus, Rhodianus, Canides, Merlinus, Raimundus Lullius, Arnoldus Villanovanus, Auguſtinus Pantheus Venetus; fœminæ tres, Cleopatra, Virgo Taphnutia, Maria Judaica; hi omnes ſolutâ oratione; unus Joannes Aurelius Augurellus Ariminenſis verſu ſcripſit.*

The Signification of Alchemy.

Now all theſe Authors gave the name of Chemiſtry to the Art of tranſmuting ignoble Metals into pure Gold; without ſo much as hinting any thing about an Univerſal Medicine. See *Conring. de Med. Herm.* 15, 16.

Origin of medicinal Chemiſtry from a miſunderſtanding of the language of Chemiſts.

Afterwards the *Arabians* begun to cultivate Metallurgy and the Art of making Gold; but they wrote in a ſtyle ſo very metaphorical and hieroglyphical, that it ſeems in the concluſion to have caus'd thoſe ſubſtances to be call'd Medicines which were employed in the buſineſs of perfecting Metals; the impure Metals were called ſick Men, and Gold meant a ſound, lively and robuſt one: The more unſkilful took it for granted at once, that theſe words were to be taken in their ſimple meaning, eſpecially when they read that the impurity of the baſer Metals was called the Leproſy, a diſeaſe of all others the moſt incurable.

From hence it is imagined the conceit aroſe and was propagated abroad, that by one and the ſame chemical inſtrument, impure Metals might be tranſmuted into Gold, and the bodies of diſeaſed perſons reſtored to health.

This Inſtrument was called the *Philoſopher's Stone*, the *Gift of Azoth*; and the Poſſeſſors of it were named *Adepts.*

A few ſimple Experiments did afterwards contribute to the eſtabliſhment of this fond opinion; that the Art of Chemiſtry might extract the ſalutary vertues of Medicines. *Rhazes* gave inſtances of it. And *Avicenna* in the eleventh Century in his book of the Force of the Heart, aſſerted it, when he mentioned the Julab of the *Arabians*, or the diſtill'd Water of Roſes, which *Meſue* afterwards confirm'd.

Writers of Alchemy after the *Greeks.*

Among the more eſteemed of theſe Authors was *Geber*, called the *Arabian*, tho' *Leo Africanus* will have it that he was a *Greek*; he was firſt a Chriſtian, but afterwards apoſtatiz'd. He wrote in *Arabic*, and liv'd in the ſeventh Century. *Golius* firſt communicated the MS. which has been ſeveral times tranſlated into *Latin*. See *Leo Afric.* l. III. p. 136. *Conr. h. m.* 369. 373. He wrote chiefly

Of Alchemy or Chemiſtry; or of inveſtigating the perfection of Metals.

Of the utmoſt perfection of Metals.

Of the dignity of Alchemy.

Of the Philoſopher's Stone.

Of the Teſtament.

Of the Epitaph.

Of the invention of the Art of Gold and Silver.

Morienus Romanus, a Hermit of *Jeruſalem*, wrote about this *Arcanum* with great purity; he is reckon'd among the moſt refin'd Authors. Tranſlated from the *Arabic* into *Latin* the eleventh of *February* 1182.

Albertus Magnus a *German* born at *Laving* in *Sweden* about the year 1100, he was afterwards Biſhop of *Ratisbon*, he wrote

De mineralibus.

Lilium floris de ſpinis evulſum.

Speculum Alchemiæ de compoſitione Lapidis, &c. See *Borellus.*

Roger Bacon a *Briton*, a Monk of *Weſtminſter*. He liv'd at *Oxford*, was eminent in Alchemy, Chemiſtry, natural Magic, Mechanics, Metaphyſics, Phyſics and Mathematics; he flouriſh'd about 1226. Among his works which have come to our hands, he wrote in an intelligible ſtyle, free from jargon, two Treatiſes concerning Chemiſtry.

Speculum Alchemiæ, and another different from the printed one, the MS. of it is in the Library of the Univerſity of *Leyden.*

De ſecretis artis, atque naturæ operibus, & de nullitate Magiæ. Specula Mathematica.

A book of his of the Art of Chemiſtry was printed at *Francfort* in 1603. 12°. It is full of admirable things in Mechanics, natural Magic and ſeveral Arts which have been unjuſtly laid claim to by ſome Moderns. He was falſly accus'd of Magic and Hereſy. *Borrich. Ort. ch.* 122. and *Borellus.*

George Ripley a *Briton*, Canon of *Bridlington*, liv'd about the ſame time. He wrote *Duodecim portæ*, *Medulla Chimica. Alchimia*, MS. in the Library of the Univerſity of *Leiden* in *Engliſh* verſe. All his works were printed at *Caſſell.* 1649. 8°.

Hermeſius the Philoſopher wrote a Diſſertation, *De Mercurio Philoſophorum* MS. in the Library of the Univerſity of *Leiden.*

Arnoldus de Villa nova, lived in the thirteenth Century. He wrote

Roſarium. Teſtamentum novum practicum. De Alchimia. Semita ſemitarum.

Roſa novella. Epiſtola ad Papam Pium.

Novus ſplendor, vel lumen. Flos florum. De furno Philoſophico. De ſecretis naturæ. De nova compoſitione Lapidis vitæ Philoſophorum. De principiis naturalibus ad Clementem Papam. Opus in Arte Majore. MS. of theſe Treatiſes is in the Library of the Univerſity of *Leiden*.

Raimundus Lullius a *Majorcan*, born in the Year 1235, Diſciple of *Arnoldus de Villa novâ*, dy'd in *Africa* 1315. He wrote, among other things, about an univerſal Remedy for all diſeaſes of the human Body, and the gold-making ſtone in his Treatiſe *de quinta eſſentia*. His works are, *De ſecretis Naturæ, ſeu quinta eſſentia, & de accurtatione Lapidis Philoſophorum. Codicillus, ſeu vade mecum. De formatione Lapidum pretioſorum.* MS. in the Library of the Univerſity of *Leiden. Clavicula de L. P. Teſtamentum Apertorium. Epiſtolæ ad Edoardum Regem Angliæ. Lux Mercuriorum. De Mercurio Speculum magnum. Teſtamentum noviſſimum. Epiſtola ad* * *Robertum Regem Angliæ. Aphoriſmi. Epiſtola accurtationum. De inveſtigatione occulti ſecreti. Exempla accurtationis.* The MS. of all theſe Tracts is in the Library of the Univerſity of *Leiden*. He is ſaid to have written at leaſt ſixty Treatiſes on chemical Subjects.

Joannes de Rupeſciſſa, a *Franciſcan* Friar, dy'd in priſon about the year 1375. He wrote ſeveral Tracts of Alchemy. See *Conr.* H. M. *Borellus*. *Paracelſus* repreſents him as a dealer in Trifles and Forgeries.

Iſaacus Hollandus, and *Joannes Hollandus*, both born at a ſmall town in *Holland* called *Stolk*. They wrote ſeveral books of Alchemy, in which there is a great number of uncommon Experiments. *De Lapide Philoſophorum. Scientia Chimiæ. De projectione infinita. De Mineralibus, & vera Metallorum Metamorphoſi. De Vino. De Vegetabilibus & aliis.*

Baſilius Valentinus, uſually ſaid to be a *Benedictine* Monk of *Erffurt*; although 'tis reported for a truth, that no ſuch Monaſtry was ever erected there; and both the names indeed ſeem to be formed from the *Greek* and *Latin*: A moſt experienced Artiſt in all the vulgar Chemiſtry, as his *Currus triumphalis Antimonii* ſufficiently teſtifies, in which book alone almoſt every chemical Artifice which is put off for new even at this Day, may be found, and is exactly deſcribed. He was a grand Proficient in the more abſtruſe part of the Art; but he certainly has this one failing, that he is too liberal in ſetting forth the extraordinary qualities of all the medicinal preparations of Antimony. His aſſertions on this head are not only to the laſt degree ridiculous and wrong, but they are likewiſe of bad conſequence. However this is an error that has taken hold of all the Chemiſts almoſt to a man, even to this day. It appears plainly enough that he was both a Divine and a Phyſician, and that his ſkill recommended him to the Courts of ſeveral Princes. He liv'd a Century before *Paracelſus*. He was the firſt

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* 'Tis *Robertum* in the Profeſſor's *Latin* Edition.

Advancer of the three chemical Principles. *Paracelſus* borrow'd a great deal from him. He wrote many things in a looſe ſtile, relating to the Art of Phyſick.

Chemical and Alchemical Phyſicians,

After the five Perſons laſt mention'd had publiſh'd their works; an opinion, as I obſerv'd before, univerſally prevail'd among the Chemiſts, that by the help of one alchemical Medicine, all the diſeaſes of the human body might be radically extirpated, perfect health reſtor'd, and the term of life protracted to any length.

Who being elated with a little ſucceſs, eſpecially upon adminiſtring Quickſilver in venereal Caſes,

So that big with hope, and grown audacious upon the efficacy of violent chemical Medicines, they made no ſcruple to proclaim a right to the whole province of Phyſick.

At that time of day the Art of Phyſick was quite over-run with the ſophiſtry of the Schools, and a jargon of words that were without meaning; and nothing would go down that bore not the ſtamp of *Galen* or the *Arabians:* So that bleeding and purging were to do every thing. The venereal Diſeaſe advancing in full career would not ſubmit to ſuch treatment, though it was unable to hold out againſt theſe more forcible chemical Medicines, and this gave the Art an opportunity to triumph; for *Carpus*, by the help of Mercury, made a meer jeſt of the Schools.

Promiſe things incredible and unheard of,

How hard was the caſe with the ancient Phyſicians, who after a ſtrict conſideration of the temperament of Patients, did point out the cauſe of the Diſeaſe, and the method of curing it: Yet did not theſe Alchemiſts ſcruple to condemn by the lump, as entirely uſeleſs, the whole tedious Labour of Ætiologics, Diagnoſtics, Prognoſtics, Dietetics, and Therapeutics; and without enquiring either into the manner of living or the nature of the complaint, cured all manner of diſeaſes with one and the ſame remedy.

but perform little.

But this mad Practice cutting off multitudes at the firſt attack, the pride of theſe men was upon due conſideration regarded as vain in itſelf and pernicious to mankind.

This appears pretty plain from the life and writings of *Paracelſus* and *Helmont*, as any one may find who pleaſes to examine them.

Paracelſus's account of himſelf.

Aureolus, *Philippus*, *Paracelſus*, *Theophraſtus*, *Bombaſt*, *de Hohenheim*, was the Son of *Wilhelmus Hohenheim* a man of Learning and a Licentiate in Phyſic, though his practice was but inconſiderable. He was owner of a fine Library, being the natural Son of a Maſter of the Teutonic Order.

He was born in the year 1493, in a village of *Switzerland* called *Einſidten* (which ſignifies a Deſart) ſituate about two *German* miles from *Zurich:* On this ſcore he was called the Hermit, and *Eraſmus*, in a letter he wrote him, gave him that appellation.

It is reported that his Teſticles were bit off by a Swine, when he was no more than three years old, and from that time he was regarded as an Eunuch: 'Tis certain that he ever maintain'd an obſtinate inveteracy againſt the Sex; yet a Picture of him drawn after the Life, repreſents him with a Beard. Having the advantage of his Father's inſtructions, he became a notable proficient both in Phyſick and Surgery; as he advanc'd in years he ſoon diſcover'd a violent paſſion for Alchemy, upon which his Father plac'd him with *Trithemius* Abbot of *Spanheim*, a perſon highly celebrated at that time of day, from whom having learnt many ſecrets, he afterwards was removed to *Sigiſmundus Fuggerus* of *Schwatzen*, who at that time, at a mighty expence, and with a great retinue of ſervants practiſed Chemiſtry in *Germany*, being no leſs remarkable for his conſtant diligence, than for the number of inventions with which he enrich'd the Art.

He owns that it was here he learned the whole buſineſs of the Spagiric Art.

After this he ſays, he viſited all the moſt eminent and ſkilful Adepts of his time, who concealed nothing from him, but freely communicated all their *Arcana*.

This however wou'd not ſerve his turn, but for the ſake of acquiring further knowledge he took a tour through all the Univerſities of *Germany*, *Italy*, *France* and *Spain*; he travel'd into *Pruſſia*, *Lithuania*, *Poland*, *Walachia*, *Tranſylvania*, *Croatia*, *Portugal*, *Sclavonia*, and all the nations of *Europe*, collecting every where from Phyſicians, Barbers, old Women, Magicians, Chemiſts noble and ignoble, the beſt and moſt certain remedies, which he joyfully treaſured up, from whatever quarter they came.

He got the Doctrine of the three Elements from the writings of *Baſil Valentine*, and without mentioning the Author's name, publiſh'd it under the names of Salt, Sulphur and Mercury.

In the twentieth year of his age he took a ſurvey of all the mines throughout *Germany*; after which he proceeded into *Muſcovy*, where upon the frontiers he was taken priſoner by the *Tartars*, and carried before the *Cham*, whoſe eldeſt ſon he accompany'd in an embaſſy to *Conſtantinople*; where in his twenty eighth year it is ſaid that he was preſented with the ſecret of the Philoſopher's Stone.

He perform'd frequent and extraordinary cures in Surgery and Phyſic, in camps, battles and ſieges.

He had a high veneration for *Hippocrates*, and the antient Phyſicians, but the ſcholaſtic Doctors, and more eſpecially the *Arabs*, he held in the utmoſt contempt.

He dealt much in mercurial and opiate Medicines, which he adminiſtred, like a bold practitioner, curing the Leproſy, Pox, Itch, Ulcers, Dropſies of the ſlighter ſort, and fix'd Pains; which Diſorders were in a manner out of the reach of the Phyſicians, who were unacquainted with the vertues of Mercury, and had rejected *Opium* as cold in the fourth degree.

First Alchemiſt that was made a Profeſſor of Phyſic.

Being arriv'd at a pitch of eminency, as well as arrogance, on account of theſe Cures, eſpecially for the ſucceſs with which he undertook *Frobænius* at *Baſil*, by this means he became acquainted with *Eraſmus*, and was invited by the Magiſtracy of *Baſil*, on the terms of a handſome ſalary, to take the Profeſſor's Chair, where he read Medico-philoſophical Lectures in publick twice every day in *Latin* and *High-Dutch*.

It was here that he read his books, *De Compoſitionibus*, *De Gradibus* and *De Tartaro*, which if we may take *Helmont*'s opinion, contain little elſe

but

but words. Here alſo he publickly burnt the works of *Galen* and *Avicenn*, and told his Audience that he would conſult the Devil, if GOD would not aſſiſt him.

He had a conſiderable number of Diſciples, with whom he lived ſome time in great harmony: Three of theſe, whom he cloath'd and maintain'd at his own expence, deſerted him, publiſh'd ſcandalous accounts of him, and made an injudicious application of his remedies to the no ſmall detriment of their Patients. He alſo entertain'd Surgeons and Barbers in his houſe, to whom he dealt out ſome of his ſecrets. Theſe alſo left him and became his Enemies. He applauds however the Generoſity and Gratitude of ſome of his Pupils, as Doctor *Cornelius*, Doctor *Andrew*, Doctor *Urſinus*, Licentiate *Pangratius*, and Maſter *Rhaphael*. When he had been two years in the Profeſſorſhip, he cured one *Liechtenfeſs* a Canon of an intolerable pain of the Stomach, with three pills of his *Laudanum*, after he had been given over by his Phyſicians. The Canon it ſeems promis'd him a hundred pieces of *French* Gold, provided he perform'd the cure, which he afterwards refuſing to pay, and ſaying in deriſion that he was cur'd only with three mice-turds, *Paracelſus* ſued him for the ſtipulated reward. The Judges not ſo much regarding the excellence of his Art, as the inconſiderable expence and trouble he was at for the Canon's relief, order'd but a trifling gratuity. *Paracelſus* made no ſcruple to call them all a pack of raſcals and blockheads, for which he had certainly been committed, had not he made the beſt of his way home, and by the perſuaſion of his Friends retreated into the Country, leaving all his chemical furniture and utenſils to *Joannes Oporinus*.

He rambled about for two years together in *Alſace*, *Oporinus* accompanying him in the quality of a companion and ſervant; here he was as ſucceſsful in his cures as he was diſſolute in his way of living. *Zwinger*, who liv'd then at *Baſil*, and had heard *Oporinus* ſeveral times tell the ſtory, relates this, *Theatr.* 1422.

Oporinus, who was eminently famous in the *Greek* and *Latin* Learning, became his companion and ſervant, in hopes ſome time or other of learning his *Arcana*, but having followed him up and down two whole years, he quitted him and return'd to *Baſil* as wiſe as he left it.

It happened one evening that *Paracelſus* was ſent for to a Peaſant who lay in a dangerous condition near *Colombaria* in *Alſace*; but being engaged at that time in a tippling bout with ſome country fellows, he put off the viſit till next day; when entring the room with a diſmal countenance, he demanded if the man had yet taken any thing? at the ſame time pulling out his *Laudanum*. Thoſe about him anſwer'd, that he had taken nothing but the Sacrament, and was now juſt departing. *Paracelſus* reply'd, in a great rage, that ſince he had made uſe of another Phyſician, he had no need of his aſſiſtance, and ſo run out of the houſe. *Oporinus* could not endure this impiety, and thereupon took his final leave of him, for fear he might ſhare in the vengeance which he believ'd hung over his Maſter's head. (*Zwinger. Theatr.* 2275.) By this time *Paracelſus* had forgot all his

Latin, and ſpent his time in rambling and getting drunk, never changing his clothes or getting into a bed; till at length, after a few days illneſs, his ſpirits being weak, but his ſenſes entire, he dy'd in a publick Inn at *Saltzburg* the four and twentieth day of *September* in the year 1541, and in the forty ſeventh year of his age, altho' from his *Elixir Proprietatis* alone he had promis'd himſelf the age of *Methuſalem.*

He publiſh'd ſome things in his life time; as the fourth part of his greater Chirurgery, which he dedicated to *Jerom Boner* Dictator of the City of *Colmar* the ſecond of *July* 1528. His book of Apoſtems he inſcrib'd to *Conrad Wiſcram* Conſul of *Colmar*. Then his books *de Gradibus, de Compoſitionibus* and *de Tartaro*; he preſented his larger Chirurgery to the Emperor *Ferdinand* on the ſeventh of *May* 1536. The ſecond part of which he likewiſe preſented to him on the eleventh of *Auguſt* 1536. In theſe he cites all the works of his that were then publiſh'd, *viz. De Archidoxis, de Sanationibus, de Sanitate Microcoſmi, & Elementorum, de Generationibus naturalium, de Suppuratione, de Signis, de Characteribus & Adeptis, de Phlebotomia, de Origine novorum Morborum, de Magia.*

Theſe particulars I have collected with no ſmall pains from his own writings, and from *Oporinus, Zwingerus,* but chiefly *Helmont,* pag. 187. §. 3. pag. 324, 325, 698, 699. I choſe not to add any thing from other Authors, which might ſavour of prejudice on the one ſide, or fondneſs on the other.

And of *Van Helmont* from his own writings,

John Baptiſt Van Helmont was born of a noble family at *Bruſſels* in 1577, ſix and thirty years after the death of *Paracelſus*. His father dy'd in 1580. He was the youngeſt of all the brothers and ſiſters; he apply'd himſelf to Phyſick without the knowledge of his friends, and againſt his mother's conſent (pag. 833.)

who was well vers'd in human, philoſophical and medicinal Literature

In 1594, being then ſeventeen years old, he had finiſh'd his philoſophical Studies (pag. 12. §. 1.) He was a prodigious reader, having twice gone through *Galen*, once through *Hippocrates*, and diligently perus'd the reſt of the *Greek* Phyſicians, with the *Arabians*, from whence he made a common place book of the moſt remarkable matters. At the ſame time he read Lectures of Chirurgery in the College of Phyſicians at *Louvain*, being appointed thereunto by *Thomas Fyenus, Gerard Villers* and *Stornius* (p. 833.)

Became Doctor of Phyſic, but deſpair'd of ever underſtanding it.

He was made a Graduate at *Louvain* in 1599, at two and twenty years old (pag. 11. §. 7.) he begun to perceive the deficiency of the Schools, long before he was capable of contriving good medicines himſelf. For it ſo fell out, that ſome how or other he got the Itch, which he ſet about to cure according to the ſcholaſtick method, but all in vain: however brimſtone did it at laſt (*pag.* 256, 257.) This put him out of conceit with Phyſic, and reflecting that he was the firſt of all his noble Family that ever took on in that way, he reſolv'd to quit it at once; and diſtributing his effects among his relations he ſet out upon travel, with a deſign of never returning again (*pag.* 833.) His Library which coſt him two hundred pieces he left behind him (*pag.* 666. §. 12.) he ſpent ten whole years in this unhappy manner (*pag.* 11. §. 7.) till receiving ſome inſight into Pyrotechny from an Idiot, he ſtuck to Chemiſtry altogether. Two years afterwards, having equipt himſelf with a parcel of chemical Medicines, he was capable of curing ſome Diſeaſes (*pag.* 833.)

In the year 1609, he married a Lady of great fortune, noble birth, and excellent qualities, with whom he retir'd to *Wilwoord*, and there by himſelf purſu'd Chemiſtry with all his might (41. §. 7. *pag.* 833, 838.)

At his firſt ſetting out he had ſeveral times like to have loſt his life by making dangerous experiments (*pag.* 719, 948.)

He viſited no Patients, nor made any gain of his Art (*pag.* 693. §. 3.)

Practis'd Phyſick,

Yet he tells us that he cured ten thouſand every year (835.)

He ſpent fifty years in Diſtillation (*pag.* 241. §. 1.) was in great eſteem with the Biſhop and Elector of *Cologn*, a perſon of great ſkill in Chemiſtry; was ſent for by the Emperor *Rudolphus*, and receiv'd invitations to two Emperors Courts, which he declin'd (*pag.* 833, 835.)

but could not cure ſeveral Diſeaſes.

He cou'd not cure two of his ſons that were ſick of the Plague, but loſt them both (*pag.* 873.) Nor could he cure his eldeſt daughter of a Leproſy, altho' he endeavour'd at it for two years together (*pag.* 714. §. 27.) nor his wife, nor his maid (*pag.* 469.) nor himſelf when he had taken Poiſon (*ibid.*)

In 1624, he printed his book of the *Spaw* Waters at *Liege*, and ſome other things afterwards.

Fell ſick and endeavour'd to recover himſelf by common Remedies,

In the ſixty fifth year of his age (*pag.* 720, 721.) after he had paſt his grand Climacterick, on the thirtieth of *January* 1640, he was ſeiz'd with a fever, attended with a ſlight ſhivering, which made his teeth chatter. He had a pungent pain about the *Sternum*, and a difficulty of Reſpiration, his ſpittle was ting'd with blood, and ſoon after what he brought up was mere blood. He took the *Penis* of a Stag ſcrap'd, and his pain abated. Then he drank one drachm of Goats blood. The bloody ſpitting was over in four days, but a little cough, and ſome ſpitting remain'd. The fever continued, and a pain in the ſpleen ſucceeded, which he remov'd by drinking a draught of hot wine with *Lapis Cancror.* ſoon afterwards all the ſymptoms diſappear'd (*pag.* 322. §. 35.) In the year 1643, the ſmoak of lighted charcoals threw him into a *Syncope* (pag. 242. §. 35.) and he reliev'd himſelf by the Sulphur of Vitriol (*ibid.*) On the eighteenth of *November* 1644, he was ſeiz'd with an Aſthma, accompanied with two pleuretic Fits, of which he lay ill ſeven weeks, and then dy'd with a ſlight fever and extreme weakneſs on the thirtieth day of *December* 1644. (*His Son in the Preface to all his Father's works, which he publiſh'd after his death.*)

and could not, but dy'd.

From whence I think it is paſt diſpute, that theſe two Authors, who were certainly the moſt famous Chemiſts that ever practis'd Phyſic, were never maſters of the univerſal Medicine which they every where make ſuch a mighty ſtir about: But that in chronical caſes, where the *Viſcera* of the Patients were ſound enough to endure the ſhock of their violent Medicines, they did a great many extraordinary things.

And it is ſomewhat remarkable that theſe vain pretenders to Longevity, both of them dy'd before they can be ſaid to have arriv'd at old Age.

Chemical Medicine in the Univerſities.

Afterwards *Franciſcus de le Boe Sylvius*, and *Otto Tachenius*, celebrated Phyſicians in their time, with their Followers, having introduc'd Chemiſtry into Medicine, made Phyſick entirely dependent thereon, both in Speculation and in Practice.

All which duly conſider'd, it will undoubtedly be of benefit to beginners to be acquainted with thoſe Authors who have ſuccinctly digeſted the Operations into proper form and order. The chief of theſe are,

Catalogue of Authors who have wrote of Operations.

Oſwald Crollius. Baſilica Chemica cum notis Jo. Hartmanni. Genev. 1658. 8°.

Johannes Hartmannus. Opera Medico-chymica. Francof. 1690. *fol.*

Glaſer. Traitè de la Chymie. Bruſſels 1676. 12°.

Le Febure. Traitè de la Chymie. Leyden 1669. 12° 2 *vol. Paris* 1660. 2 *Vol.* 8°.

Lemery. Cours de Chymie. Leyd. 1716, 8°.

Le Mort. Chymia Medico-Phyſica, &c. Lugd. Bat. 1696, 4°.

Barchauſen. Puroſapia. Lugd. Bat. 1698. 4°.

Metallurgic Authors.

In the metallurgic part of the Art, the moſt valuable are *Geber*, often printed in ſeveral ſizes.

Georgius Agricola. De Re Metallica Lib. xii. &c. *Baſil.* 1657.

Lazarus Erkern. Beſchreibung aller furnemiſten Mineraliſchen ertz, und bergwerks arten &c. Francf. 1629. *fol.* The ſame in 4°. *Francf.* 1694, entitled, *Aula ſubterranea alias Probirbuch Lazari Erker.*

Jo. Rudolph. Glauber. All his works publiſh'd ſeparately, at different times, and in various ſizes,

Joachim. Becher. Metallurgia Becheri. Francf. 1660. 8°.

Joannes Kunkel. Philoſophia Chymica, experimentis confirmata. Amſtelæd. 12°.

Olaus Borrichius. Docimaſtica metallica Hafniæ 1680. 8°.

Alchemiſts.

In Alchemy the following are of the beſt repute.

Geber, which *Bernardus* reckons among the Sophiſts.

Morienus.

Roger Bacon.

George Ripley.

Raimundus Lullius.

Bernardus Comes Treviſanus. He wrote in 1453.

Joannes Iſaacus Hollandus, and who perhaps is the ſame.

Iſaacus Hollandus, who is older than *Arnoldus Villanovanus*, and more modern than *Paracelſus. Penotus* had ſuch a value for him, that he imagin'd him, lying in obſcurity in *Paracelſus*'s time, to be *Elias* the Artiſt, the promis'd revealer of ſecrets. *Libav. Alchimia Pharmaceut.* 122.

Baſilius Valentinus. Chymiſche Schrifften. Hamburg 1694.

Artephius.

Theatrum Chemicum.

Turba Philoſophorum.

Paracelſus è Opera omnia Latine Genev. 1658. 2 vol. fol.

——————In *High-Dutch*, *Straſbourg* 1603. 2 vol. fol.

——————In *High-Dutch*, *Straſbourg* 1616. 2 vol. fol.

Ireneus Philaletha.

Michael Sendivogius.

John Baptiſt Van Helmont. Opera omnia. Amſtelod. 1652. 4to.

Chemical Authors in Medicine and natural Philoſophy.

For Chemiſtry apply'd to Medicine and Natural Philoſophy.

Helmont.

Robert Boyle in all his writings.

Joannes Bohnius. Diſſert. Chymico-Phyſicæ Lipſ. 1698.

Dr. *Cox* and Dr. *Slare* in ſeveral of the *Philoſophical Tranſactions of the Royal Society.*

Mr. *Homberg*, Mr. *Geoffroy*, and Mr. *Lemery* the younger in the *Memoirs of the Royal Academy of Sciences.*

Georg. Erneſt. Stahl. in his *Fundamenta Chymiæ. Norimb.* 1723. 4°.

And above all, as they are of excellent ſervice to the Art. *Obſervationes Phyſico-Chymicæ ſelectiores libris tribus comprehenſæ*, publiſh'd at *Hall* 1722, by the very ingenious *Frideric Hoffmann*, a Gentleman who has enrich'd both Phyſic and natural Philoſophy with a very fine ſet of Operations.

COLLEGIUM

COLLEGIUM CHEMICUM.

PART II.

BEING A

Delineation of the Theory.

Definition of Chemiſtry.

CHEMISTRY is an Art which ſhews the manner of performing thoſe phyſical Operations whereby ſenſible bodies, or ſuch as may be render'd ſenſible, and are capable of being contained in Veſſels, are ſo chang'd by means of proper Inſtruments, that their certain and particular effects are thereby diſcovered, and the cauſes of thoſe effects explain'd from the effects themſelves, to the ſervice and improvements of various Arts.

It certainly is entitled to the name of an Art, becauſe it directs to ſuch and ſuch actions as the underſtanding foreſees will produce ſuch and ſuch ends.

Objects of the Art.

The Objects, in whoſe changes and obſervations it is concern'd, are all ſenſible Bodies, whether they naturally offer themſelves to the ſenſes, or are rendered cognizable to them by the help of Art, or by their Effects, although they were not ſo before; eſpecially if they are ſo conſtituted in themſelves, as to be receiv'd into Veſſels, or can by dint of Art be confined in them.

Diſtinguiſh'd into three Claſſes.

All which duly conſider'd, they may conveniently enough be diſtinguiſh'd into three Claſſes, uſually named Kingdoms.

The firſt Foſſils. Definition of Foſſils.

Foſſils, vulgarly called Minerals, make up the firſt Claſs: Theſe we define natural Bodies generated in the Bowels, or on the Surface of the Earth; whoſe contexture is ſo ſimple, that no obſervation, even with the aſſiſtance of Microſcopes, can diſcern any difference between their Veſſels and what is contained in them; or that the parts do any ways differ from the whole; altho' in many of them it is out of all diſpute, that there is a mixture of fluid and ſolid parts. The Chemiſts give them the title of the Mineral Kingdom.

Of Metals.

Of which firſt Metals. Definition of Metals.

Among theſe, Metals come firſt in order, which are defined, The moſt ponderous Foſſils, becoming fluid by fire, and conſolidating by cold; in which latter ſtate they are malleable and ductile.

There have hitherto been diſcover'd no more than ſix ſimple Metals, Gold, Silver, Copper, Tin, Iron and Lead.

The antient Philoſophers inſerted Mercury in the Liſt, although, as it has no pretenſions to Hardneſs, Ductility, or Fixity, it muſt be a thing of quite another ſort: yet the place of its production, its weight, ſimularity of Parts, and eaſy union with Metals, have given riſe to a very old opinion, which ſtill gains ground, that it is the principal Matter of all the reſt.

The antient characters of Metals.

It ſeems ſomewhat wonderful that in their ſacred myſteries the ancient *Perſians* ſhould always give the names of the ſeven Planets which they ſaw in the Heavens, to the ſeven Metals they obſerved to grow in the Earth.

Moreover by the ſame Characters ☉, ☾, ☿, ♀, ♂, ♃, ♄, Aſtronomers and Aſtrologers have mark'd the celeſtial Bodies, and Chemiſts the Metals.

The meaning of theſe Characters.

Although it may be a matter of controverſy, which of the two firſt made uſe of theſe Characters, it is however certain that the Chemiſts have well adapted them to the natures of their Bodies, as will appear if we rightly conſider the thing.

🜊 Denotes whatever is acrid, or corroſive, as Vinegar, Fire, &c. as if furniſh'd with ſharp ſpikes.

☉—— ſomething perfect, immutable and moſt ſimple, as Gold, which contains nothing acrid, or exotic.

☾—— half-gold; whoſe inſide turned outwards, makes perfect Gold, without any thing exotic or corroſive. This the Alchemiſts obſerve of Silver.

☿—— the inward part to be pure Gold; but the colour of Silver above, with a portion of acrid and corroſive at the bottom. This the Adepts pronounce of Mercury.

♀—— the principal part to be Gold; but that a conſiderable portion of a crude acrid, and corroſive adheres to it; which, when ſeparated, leaves the reſt with all the properties of Gold. This alſo the Adepts do aſſert.

♂—— that there is alſo Gold within, but that there is likewiſe a conſiderable part of corroſive acrid; tho' it amounts to but half the former Acrimony; the Character repreſenting but one half of that quality: this the Chemiſts pronounce, and the Phyſicians experience. Indeed the Adepts, almoſt to a man contend, that live or philoſophical Gold lies conceal'd in the body of Iron, and that therefore a metalline Medicine is not to be ſought for in Gold itſelf, but in this Metal.

♃—— that the one half of Tin is Silver, and the other a crude corroſive Acrimony: This almoſt any docimaſtic trial evinces: The Cuppel ſhews that it has a fixity not unlike that of Silver, and likewiſe a copious quantity of crude Sulphur, which the Alchemiſts are well appris'd of

♄—— that it is almoſt all corroſive, with ſome ſimilitude of Silver. This hint to the ſkilful is ſufficient.

♁ —— Chaos, τὸ πᾶν, the world, one in which all reſide. Gold, and a copious arſenical corroſive.

The individual and proper characteriſtic of Metals, is their very great weight, far exceeding that of all other bodies.

Weight the principal and certain mark of a Metal.

A catalogue of their ſpecific Gravities compar'd with that of Water.

☉.	19636.
☿.	14019.
♄.	11345.
☾.	10535, 11087.
♀.	8843.
♂.	7852.
♃.	7321.
Granate	3978.
Glaſs	2805.
Pump Water	1000.

Weight the beſt diſtinguiſhing Mark between one Metal and another.

From *Philoſoph. Tranſact.* N° 169, *pag.* 926, and N° 199, *pag.* 694.

This is the beſt method of examining unknown bodies, to be ſatisfy'd whether they contain any quantity of Metal.

And it often diſcovers what Metal it is,

And how difficult a matter it is to augment the weight of a Body ſo, that by condenſing the other Metals they may become Gold, or other bodies become Metals.

Likewiſe what matter is next to Gold, ſo as to be convertible into it, with reſpect to its weight.

And finally, that a certain demonſtration may be had from weight.

☉. 1. Is the moſt ponderous and denſe of all Bodies.

2. The moſt ſimple.

3. The moſt fix'd in Air and in Fire. Inſomuch that ℥j. thereof kept in fuſion two months together in the Eye of a Glaſs-houſe furnace, loſt not a ſingle Grain, whence it muſt be incorruptible.

4. It is the only Body which reſiſts the force of , and of ♄; not changing to *Scoriæ* with them, but when they are flux'd together ſinks to the bottom. From whence we find it to be the moſt unchangeable of all known bodies, it being perhaps out of the power of phyſical cauſes to alter it, and the moſt ſage Alchemiſts do univerſally pronounce it a matter of leſs difficulty to make it, than to deſtroy it by Art.

5. It is the moſt ductile of all Bodies. Artificers can diſtend under the hammer, a ſingle grain of Gold between ſkins made of Ox-guts, to ſuch a degree that it ſhall form a Leaf, containing thirty ſix ſquare Inches and an half, and twenty four ſquare Lines. Forty eight ounces of Silver form'd into a Cylinder, are gilt with one ounce of Gold; which then are drawn into Wire ſo ſmall that two yards thereof weigh but one Grain, and conſequently the Superficies contains no more than $\frac{1}{49}$ of a Grain of

Gold, yet this altho' it be obſerv'd with a Microſcope, ſhall no where diſcover the leaſt Particle of the included Silver. Hence $\frac{1}{1000000}$ of a Grain of Gold may be render'd viſible to the naked Eye. And the thickneſs of this viſible Foliage will be $\frac{1}{134500}$ of an Inch. Dr. *Halley. Phil. Tranſact.* N° 194, p. 549. And in the *Memoirs de l'Acad. R. Sc.* 1713. 10. it is made appear, that the thickneſs of the Gold, on a very fine ſilver Wire gilt, is no more than $\frac{1}{105000}$ of a Line. A ſingle drop of *Aq. Reg.* in which Gold has been diſſolv'd, mix'd with a pint of rectify'd Spirit of Wine gives the whole a metalline taſte, and communicates to two Grains of a Solution of Tin mix'd up in a large quantity of Water, a dark purple Colour. One *Hoffman* an Artificer of *Auſbourgh* had ſo exquiſite a way of managing Gold, that with one Grain thereof he could make a Wire five hundred feet long. *Caſſius de Auro*, pag. 77.

6. It is ſoft, ſcarcely elaſtic, but ſonorous.
7. It runs in the Fire when it is ignited ; and there is a ſort of it in *Madagaſcar* ſo very ſoft, as like Lead to be melted with a very gentle heat. *Flacourt. Hiſt. Inſ. Madagaſ. Borrich. Ort.* Ch. 49.
8. Nothing diſſolves it beſides Sea Salt, or *Menſtruums* compounded of it, for no other Salts do in the leaſt affect it : And as the Particles of *Aq. Regia*, or Spirit of Sea Salt, are never ſo far volatiliz'd as to float in Air, it cannot be ſubject to ruſt.
9. It readily unites with purified Mercury, though it comes not eaſily into ſuch union with that which is crude, even by the help of Fire.
10. If it be diſſolv'd in *Aq. Regia*, and precipitated with Salt of Tartar, it acquires a fulminating Quality.

Gold never contracts ruſt, nor is it diminiſh'd by Exhalation : Nature gives it perfectly pure in Grains and Glebes, ſome of which have amounted to two pounds, and ſuch Gold is called *Obryzum* ; ſometimes it requires fuſion ; for 'tis very ſeldom that a foſſile Glebe contains pure ☉, without ſome admixture of other Metals, unleſs it be perfectly united, and then it holds Silver, but, it is very rare that any of the other Metals are found mix'd with it beſides ☾ and ♀. Moſt parts of the world afford it more or leſs ; it is found in a white Glebe with black Spots, and this is eſteemed the beſt ; 'tis likewiſe black, red, or yellow. The Glebe that is dug up about Gold Mines is intermix'd with white, blue, red, and green Vitriol, as likewiſe with ♁ of Gold, as 'tis called.

It is ſeparated from its Ore, 1. By a reverberatory Fire, which ſends off the volatile part of it. 2. By Coction in Water, whereby the ſaline and pinguious parts are ſeparated. 3. By Trituration with Mercury, if the Maſs be not pinguious. 4. By Trituration with ☿ and the Calx of Vitriol, if it be more pinguious than ordinary, the Matter thus triturated being afterwards boiled in Water. 5. By *Aq. Regia.* 6. By ſuch Salts as fix the rapacious volatile Fat or Salt, with which the Gold would fly off with conſiderable loſs in the Fire. 7. By waſhing with Water; which method is chiefly us'd in what we call Gold-duſt.

On theſe matters ſee *Lazarus Erker*, the Lord *Bacon*, and the *Philoſophical Tranſactions.*

Proper Marks of Mercury.

☿ 1. Is the heavieſt of all Bodies, except Gold.

2. It is the moſt ſimple of all Bodies, even more ſimple than pure Gold, when 'tis thoroughly cleans'd.

3. It is totally volatile in the Fire, with a degree of heat not much exceeding that which is requiſite to make Water boil, it ariſing in the likeneſs of Smoke.

4. 'Tis no ways diſtendible under the hammer, but is ſeparable into exceeding minute parts by a very ſmall Force; and the more ſo, the purer it is. It is not reducible to a ſolid Maſs by any known degree of Cold; may it not therefore be fluid Gold?

5. It adheres to Gold more eaſily than to any other Metal; alſo to Lead, Silver and Tin, but with ſome Difficulty to Copper, and hardly at all to Iron. Do not then Metals unite ſo eaſily with Mercury, the baſis of them all, by a certain affinity in their natures, and the more readily as the Metal partakes of a larger portion of Mercury, and a leſs of any exotic Matter? It ſeems probable that it is ſo.

6. It diſſolves in *Aq. Fortis*, and in *Aq. Regia.*

From whence it appears how difficult it is to tranſmute ☿ into ☉; ſince it muſt firſt of all acquire the ſame weight, fixity and ductility: And yet Mercury is very much of the nature of Gold.

The greateſt part of it comes from *Idria*, where it grows, 1. In an Ore as hard as Stone and of the Colour of *Crocus Metallorum.* 2. In a ſoft Mould, which yields fluid Mercury. 3. In globular Stones. 4. In Cinnabar.

It is ſeparated from its Ore by Diſtillation, Cribration, or Lotion with Water. That which is found ſpontaneouſly fluid, without the help of Fire, is called Virgin Mercury.

Marks of Lead.

♄. 1. Is the next heavy Body after Mercury.

2. It appears from all kinds of tryal to be very ſimple.

3. It fumes in the Fire, and after it has been a good while in fuſion paſſes through moſt ſorts of Veſſels: it is not fix'd.

4. It is the ſofteſt of all Metals, void of all Elaſticity, not ſonorous, but very ductile.

5. It melts the eaſieſt of all Metals, except Tin, and that with a very moderate heat; it throws up a Calx long before it ignites, ſoon after which it turns to Glaſs, which Glaſs, when in fuſion, no Veſſel is able to contain. All lighter Bodies thrown into it inſtantly riſe to the Surface. It vitrifies with impure Metals, carrying them along with itſelf from the concave ſurface of the Teſt, leaving only ☉ and ☾ pure from any heterogene Mixture: The reſt it either diſſipates in Fume, or carries with itſelf through the pores of the

Teſt: it quickly reſumes its Solidity after fuſion, though not ſo ſoon as Tin.

6. It diſſolves in *Aq. Fortis*, but not in *Aq. Regia*; and it affords a ſweet Salt.

It is common in a great number of Mines throughout *Europe*; 'tis found in large quantities, and there is a conſtant conſumption of it. Although it be ſo cheap a Metal, yet is it of a wonderful nature, and of ſingular uſe: The Mythologiſts call it the Origin and Father, as well as the Devourer of other Metals.

7. Its Ore is ponderous, ſparkling and of a lead colour, yielding one half Metal; ſometimes it is white, red and yellow, but then it is not ſo rich; it often holds ſome portion of Silver; on which ſcore many perſons, for want of due caution, are impos'd upon.

Marks of Silver.

☾ 1. Is the next in weight.
2. It is likewiſe ſimple, not diſcovering any diſſimularity of Parts, by any artifice in common uſe.
3. It remains ſo fix'd in the Fire as to loſe hardly any thing, provided it be pure. It is ſaid to have undergone a two months fuſion in the Eye of a Glaſs-furnace, loſing but $\frac{1}{12}$ of its weight, and then perhaps it was not perfectly pure.
4. 'Tis malleable, and capable of being drawn into exceeding fine Wire.
5. It melts as ſoon as it ignites.
6. It diſſolves in *Aq. Fortis* alone.
7. It is refin'd by Lead, and is not deſtroy'd by it.
8. With Antimony it turns to *Scoriæ*, and becomes volatile.

'Tis found in a great many places, in various ſorts of Ores, and always holds a ſmall quantity of Gold. Its Ore frequently participates of a corroſive, bituminous Sulphur, which renders the Silver volatile and diſſipates it, or elſe turns it into Glaſs with great loſs. This Sulphur cannot be ſubdued either with Salts, or Lead, and is deſtroy'd by Mercury alone, which they throw in upon the Ore whilſt under Calcination, rubbing them together a conſiderable while. Thus is the Mercury united with the Silver, and is afterwards ſeparated from it by Diſtillation, *Tranſact. Abridg.* 589, 590, 591.

Marks of Copper.

♀ 1. Its weight is next to that of Silver.
2. It is ſimple, but leſs ſo than the former ones.
3. It ſeems fix'd in the Fire, yet does it emit Fumes, and is in part volatile.
4. It is diſtendible under the hammer, and may be drawn into fine Wire. It is very elaſtic and ſonorous.
5. It ignites ſome time before it melts. It is brought to fuſion with the moſt difficulty of any Metal, except Iron, it raiſes a wonderful conflict with Water, when it is in fuſion, the leaſt drop which lights upon it in that circumſtance bringing terrible danger with it.

6. Any kind of Salt diſſolves it readily, and then it is either green or blue; but upon the ſudden removal of the diſſolvent, it becomes of a foul hue, and loſes its former beauty. In Air and in Water it turns to Verdigreaſe, which is a *congeries* of very ſmall Cryſtals.
7. It very readily changes to *Scoriæ*, and vitrifies with ♄ and ♁, ariſing from the Teſt in fumes, or ſinking thro' it.

Mines every where abound with it. It adheres ſtrongly to its ſtony Ore, inſomuch that it often requires fourteen fuſions to make it pure. Silver often goes along with it in the black, or diluted blue Ore, though it ſeldom is found if the Ore be yellow, green or brown. Vitriols, green, blue, red, and white, as alſo beautiful green and blue Stones are frequently found among its Veins. In a word, no metalline Foſſil exhibits ſuch a variety of colours.

Properties of Iron.

♂ 1. Is likewiſe diſtinguiſhable by its ponderoſity.
2. It is not ſo ſimple as the former ones, for it affords undeniable marks of a crude adherent Sulphur, and of a matter ſo combuſtible in its nature, as ſometimes to kindle into real flame.
3. It is fixt in the fire, altho' it fumes and ſends off ignited ſparkles, and ſo continually loſes of its ſubſtance.
4. It is diſtendible under the hammer, and may be drawn into Wire, although not very fine, without ſplitting or breaking. It is hard and ſonorous.
5. It ignites a long time before it melts. A vehement fire is neceſſary to put it in fuſion, which ſtate it is brought to with more difficulty than any other Metal. It well enough endures the contact of cold Water when ignited.
6. It is readily diſſolved by all Salts, and then changes to a reddiſh colour; it quickly deſtroys its ſolvents, and turns to *Scoriæ*; hence 'tis a difficult matter to preſerve it from ruſt.
7. 'Tis ſoon deſtroy'd among all other Metals; and with ♄ or ♁ it preſently turns to *Scoriæ*.
8. It attracts the Load-ſtone, and is attracted by it.
9. It acts by a medicinal power on the human body, and therefore is not probably of a nature ſo repugnant thereto as other Metals are, ſeeing it is in a manner totally diſſoluble therein.

Iron ſeems to be the produce of every country, being diſſeminated among fat argillaceous earths, which upon ſmelting, exhibit the Metal of a red colour. It diſcovers itſelf in a ſtony Ore, of a reddiſh complexion; or if the vein be rich, a weakiſh blue. This Ore has often a magnetic virtue. It is eaſily diſtinguiſht in the foſſile green Vitriol: but it ever requires a vehement heat to disjoin it from the Ore, as well as proper fluxes, and previous roaſting.

Character of Tin.

♃ 1. Is the lighteſt of all Metals.
2. It is far leſs ſimple than the preceding ones; ſending up ſulphureous fumes with the leaſt heat, which are eaſily ſeparable therefrom, and are in a manner combuſtible.

3. Hence it ſuſtains the fire a far leſs time than the reſt.

4. It is ſoft, flexible, diſtendible under the hammer, and may be drawn into wire, though not near ſo eaſily as the others. It is not very ſonorous, or elaſtic.

5. It melts in the fire ſooner than any of the other Metals, a great while before it ignites, and with a heat not much greater than that of boiling water; and it quickly conſolidates again by cold.

6. When it is crude, and united with its proper adherent Sulphur, it is diſſoluble in *Aq. Regia* only. When it is purified from its Sulphur by calcination, even vinegar will diſſolve it; nor does it need any large quantity of the ſolvent.

7. It reſiſts the force of ♄ and ♂ on the teſt, and can hardly be ſeparated from them; indeed not at all, without the help of ♀.

8. It reſembles Silver in many of its properties.

Its Ore is very ponderous, although it be light in itſelf; ſometimes 'tis found in a Glebe of a browniſh yellow, but the richeſt is blackiſh, ſmooth and ſhining. Again, it is like Iron Stone; there is alſo a ſort of it which looks like a porous, though weighty Stone. It is prepared by roaſting, ſtamping and waſhing; after which, the Metal is ſeparated from the *Scoriæ* by fuſion. *Great Britain* abounds with the beſt ſort of it: *Bochart* will have it that the Iſland took its name from *Barat Anac*, which in the *Syriac* language, ſignifies a field of Tin.

This true hiſtory of Metals ſhews,

Foundation of tranſmuting Metals.

1. That Metals do abſolutely differ from all other natural or artificial bodies which we are hitherto acquainted with: the lighteſt of them being above twice as heavy as the moſt ponderous body that is not a Metal.

2. That therefore they are entirely miſtaken, who think by any ſort of change to bring Metals out of any ſubſtance that is not metalline: the neceſſary condenſation is that point which of all others is the moſt difficult to arrive at, ſince the weight is the very index of the corporeal maſs, and needs ſomething like a creating power to produce it.

3. That the affinity which ſubſiſts between the intimate ſubſtances of the ſeveral Metals, is not more plainly evinc'd by any one mark, than by the ſimularity of their weights.

4. Nothing therefore is more like Gold than Mercury, with regard to the quantity of matter in each: The other principle which gives to each its particular form, I don't here examine into; it appears however to be of quite another nature than that of weight.

5. That the other properties of Metals, as fixity, colour, malleability and ſimplicity, may be in probability more eaſily produced and altered.

6. That therefore Gold conſiſts of a matter, like that of Mercury, very pure and ſimple, which is fixt by another principle, perfectly pure, ſimple, and ſubtile, diffuſed through its minuteſt parts, ſtrictly uniting them one with another, and itſelf with them.

7. That the other Metals conſiſt of the ſame principles, but with a mixture of ſome other lighter matter, which is various in different Metals, called

Earth; that they are therefore compounded of a threefold matter; and among ſome of them a crude Sulphur alſo comes in.

8. That therefore they are reſpectively reſolvable into their particular natural and numerical Elements.

9. That this may be done by ☿, a reſuſcitating ſalt, or fire, in different Metals by another way.

10. That therefore it is an erroneous notion that Metals are eaſily convertible into one another, further than regards the mercurial part of them; their ancient form being firſt quite deſtroyed. Whence it is impoſſible, that more gold can be produced out of another Metal by tranſmutation, than holds proportion to the Mercury that is in it.

11. Nor does it, *bona fide*, appear that any Metals different from the ſix, before mentioned, were ever artificially produced. Although *Helmont* roundly aſſerts the thing of Mercury fixt by the *Alkaheſt*.

12. A perſon therefore, who rightly comprehends all that we have here laid down concerning Metals, will not eaſily be deceived by the promiſes or boaſts of pretenders: ſince no one of them all is able to produce the weight of Gold, or the fixity of Gold and Silver in the fire. Theſe diſtinguiſhing marks will ever ſecure him againſt tricks, plauſible reaſonings, and ſpurious artificial Metals: without taking notice that ſuch are generally deficient in point of malleability.

13. That the ſix Metals, when under the ſtate of fuſion in clean veſſels, do all appear alike, and in every reſpect reſemble Mercury, whether it be in ſimilitude of colour, ſolidity, ſpheroidal ſurface, attraction of parts, manner of running, or mobility. Hence perhaps ☿ may be a Metal in fuſion by a very ſmall degree of fire. ♃. One that may be put in fuſion by a ſomewhat greater degree of fire, and if the air were hot enough to produce this effect then would ♃ be ☿, but fuming and throwing up a ſpume. So alſo ♄ would be ☿ with a degree of heat a little more encreaſed, but ſpuming, and eſcaping through the veſſels. ☾ and ☉ with a far more exalted degree of fire would be fluent, immutable ☿. ♀ too would be ☿ requiring a ſtill more intenſe heat to make it fluent, yet would it be mutable. And laſtly ♂ would be ☿ becoming fluid with the greateſt difficulty, but mutable.

Of Salts.

After Metals come Salts, called concreted juices. They are extremely ſimple, and enter into the compoſitions of Semi-metals, and other Foſſils.

Salt is a Foſſil diſſoluble by fire and water, ſo ſimple that every one of its parts are perfectly of the ſame nature with the whole, and impreſſing taſte on the tongue. Definition of Salt.

Natural Salts are, Sea Salt, *Sal Gemmæ* or foſſile Salt, Spring Salt, Nitre, Borax, native Sal-Ammoniac, Allum, vague mineral Acid. Species.

Foſſile Salt, whoſe more pure part is called *Sal Gemmæ*, is found in full perfection in Mines all the world over, in vaſt quantities, and commonly lies very deep. Foſſile Salt.

Spring Salt.

Spring Salt is found frequently diſſolved in water; when purified and cryſtallized it is very like Sea Salt.

Sea Salt.

Sea Salt is procured from Sea Water, by evaporation, purification, and cryſtallization.

Theſe three kinds of Salts, tho' they are of different origin, yet are of the ſame nature, and are diſſolved in the ſame quantity of water, that is 3¼ times their own weight; they run *per deliquium* in air; they form very near the ſame kinds of cryſtals, which according to the time taken up in the cryſtallization, are cubes, paralleopipeds, or pyramids; being added to *Aq. Fortis* they diſſolve Gold; in diſtillation by fire they become acid ſpirits of the ſame nature; when diſſolved in a moiſt air they depoſit a conſiderable quantity of earth; and become a pinguious, acrid, auſtere liquor; they crackle in the fire, which if it be intenſe, melts them: they remain fixt a conſiderable while therein, provided they are pure, undergoing no alteration, nor ſeparating any ſpirits, and but a very little water; they contain no alkali, nor are they capable of change by putrefaction.

Nitre.

Modern Nitre, or Salt-petre, forming octagonal cryſtalline priſms, is a ſemi-foſſil obtained from a nitrous acrid earth, being fuſible in a moderate fire; it evaporates little or no water, and is ſufficiently fixt; it deflagrates, when in fuſion, with all inflammable ſubſtances. It diſſolves in 6⅓ its weight of water.

This nitrous quality is communicated to earths and rocks by the excrements of animals, or their putrified carcaſſes, ſuch eſpecially as take in no Sea Salt with their food, of which birds are far the more numerous ſpecies. It is prepared by the addition of unelixiviated aſhes of vegetables, and quick-lime, after which it is diluted with a large quantity of water, filtred through ſand, and cryſtallized.

Nitre is generated from a pinguious and alkaline earth, and the air, *Hoffm. de Eſt. Aq. min.* T. 2. p. 42.

Borax.

The third is Borax, or *Cryſocolla*. It is a variouſly figured Foſſil; it requires a large quantity of water, even above twenty times its own weight, to diſſolve it, together with a conſiderable degree of heat; its taſte is bitteriſh, inclining to ſweet at laſt; it eaſily fluxes with fire, ſwelling up in ſpume, and letting go a large quantity of water, the reſidue ſubſiding in the form of a beautiful glaſs; it exceedingly promotes the flux of bodies it is mixt with, on which account it is an excellent inſtrument in ſoddering Metals, eſpecially Gold.

Foſſile Sal-Ammoniac.

The next is Sal-Ammoniac, or *Sal Arenarius*, which is generated in the hotteſt and drieſt parts of *Africa*. This is the *Sal Cyrenaïcus* of the Ancients; a great deal of it is found in the neighbourhood of the Temple of *Jupiter Ammon*. *Pliny* has deſcribed the beſt ſort, which ſeems not unlike the modern Sal-Ammoniac. The like is frequently met with near burning mountains in diverſe parts of the world, but that of *Veſuvius* is the moſt in eſteem, even at this day.

The factitious modern ſort.

I have claſſed it among Foſſils, though that which is brought us from *Egypt* is thought to be an animal production. It is a queſtion, whether every ſort of it be not made from ſoot?

Acid foſſile Salt.

The fifth ſort of foſſile Salts is a vague, acid, volatile liquid, plentifully abounding in every Mine. 'Tis probable that this, united with foſſile oil, *Pretroleum*, oil of earth, and the like ſubſtances, conſtitutes the various kinds of native, foſſile, pellucid, quick ſulphurs both fluid and ſolid; as alſo with ſemi-metals, ſuch as cinnabar and antimony, and other foſſils, and with metals the ſeveral ſorts of vitriol; and with calceous earths the ſeveral varieties of allum. From the pyrites, which is the *Matrix* of vitriol, calcined in a quick fire, it produces common ſulphur.

Is not this very much of the ſame nature with that acid which kindled ſulphur diffuſes from its blue flame, ſo ſuffocating and noxious to all animals? An analytical inquiry ſeems to indicate it.

On which ſcore it may be perhaps juſtly regarded as a kind of male Salt, that impugnates female Salts and Earths.

Allum.

The ſixth is Allum, which is a real Foſſil, and being obtained from a rocky ſtone which lies deep in the earth, is hard and fiſſile, replete with *bitumen* and ſulphur, and eaſily calcined; or from a bituminous earth, which is combuſtible, and ſends forth a noxious ſulphureous flame. If this matter be expoſed for a month in the open air, it becomes a powder, and is then fit for making Allum, which it was not before.

If the rocky ſubſtance be employed for the purpoſe, then it muſt be firſt expoſed to the air, and afterwards calcined, from whoſe flame it is evident that it holds a deal of Sulphur.

Having undergone ſuch a preparation in the air, or both in the air and fire, if the rocky ſort, it is then diſſolved in water, and precipitated by the addition of a fixt or volatile alkali, which occaſions an efferveſcence: thus a predominating acid being mixt with the alkali, a new Salt ariſes partaking of the air, the alkali, and the foſſil.

After the precipitated matter is ſeparated from its *Lixivium*, it is diſſolved in boiling water, which is evaporated to inſpiſſation, and the remainder being ſuffered to ſettle in a tub, ſhoots into red or white cryſtals of an octagonal ſhape, and of a ſweetiſh auſtere taſte, which are hardly liquefiable in air, and require fourteen times their weight of water to diſſolve them.

The acid liquor of Allum ſeparated by the force of fire is almoſt in every reſpect like *Ol. ſulphuris per campanam.*

After the ſeparation of which acid, there remains an abundant *fæx* or light ſubtile earth, which very much reſembles bole.

If it be calcined in a triple quantity with the coat of any inflammable matter, it is then Mr. *Homberg*'s *Phoſphorus*, whence it ſeems to poſſeſs a very ſingular quality of exciting fire upon the admiſſion of air.

Principles of foſſile Salt.

In the formation of foſſile Salts, nature ſeems to have made uſe of a threefold acid; namely, ſpirit of Salt, and ſpirit of Nitre both in a copious quantity, and ſpirit of Sulphur in a leſſer; as likewiſe water, and earth.

Of Sulphur.

Sulphurs chiefly make up the third claſs of Foſſils; ſome other matters alſo coming under the ſame rank.

Sulphur. Sulphur is a foſſile body, which when cold is hard, and eaſily reduced to powder by trituration, but diſſolves like wax with a moderate heat; capable of being totally ſublimed by fire without alteration in a cloſe veſſel; melting in the fire upon the admiſſion of air, and totally conſuming with a blue flame, and a volatile vapour which kills animals.

Sulphur-vive. This is got out of the earth in ſmall quantities; being of a tranſparent yellow like amber, or a red like a ruby, which is called golden Sulphur; or an opaque yellow, cineritious, or variegated, and then it is called Sulphur-vive, or Virgin Sulphur.

Vulgar. That which is ſold all *Europe* over, is artificially produced from the pyrites, though it could hardly be diſtinguiſhed in it before; for its *Matrix* by the action of fire exhales nothing like Sulphur, but an acid liquor like the acid of vitriol.

But when it is prepared according to art, it then by the action of the fire yields real Sulphur.

And ſuch real Sulphur is produced from it by the continual ſtreſs of a violent fire, till it ſoftens, calcines, and cleaves aſunder.

When the Sulphur ſo prepared reſides in the *Matrix* the whole is put in fuſion, and by inclining the crucibles, the Sulphur runs off into receivers placed beneath for that purpoſe.

Now the *Matrix* of Sulphur and Vitriol has one and the ſame vein.

Hence it may be artificially compounded of the oil of Vitriol, Alum, or Sulphur *per Compan.* and an oleous vegetable ſubſtance, properly united.

So that the name which Artiſts have given it of the reſin of the earth, is not an improper one.

After it has been purified by ſeveral fuſions from the foulneſs which floats on the ſurface, or ſinks to the bottom, and is caſt into cylindrical wooden moulds, it becomes the common Sulphur of the ſhops, the beſt being of a bright lemon colour.

Orpiment. Orpiment has many things in common with Sulphur: it is friable, fuſible, and eaſily inflammable, in which circumſtance it emits a ſulphureous ſtench, but no volatile acid; it is inactive and harmleſs, being not of that deadly conſequence to animals as is commonly reported: it grows reddiſh upon fuſion, and then it yields a volatile ſubſtance of an emetic quality. It is falſly called yellow Arſenic.

This native Orpiment by fuſion in a cloſe Veſſel, becomes a brittle Maſs, eaſily pulverable, of the colour of Vermilion; pretty free from acidity, or any poiſonous quality; and yet both the Ancients and Moderns have given it the names of Realgar, red Arſenic and *Sandaracha*; and by ſuch a confuſion of terms, laid the foundation of thoſe errors that have crept into the Art concerning it.

Modern white Arſenic.

The moſt poiſonous Arſenic is a white, cryſtalline, ponderous, triturable body of late invention, having not been known above two hundred years, and is an artificial production. Whilſt Cobalt is putting in fuſion, being mixt with a fixt Alkali, and powder'd flints for the making of Smalt, flowers ariſe, which is the crude, white Arſenic; this is flux'd with a vehement fire in a cloſe veſſel, and ſo becomes the white Arſenic of the ſhops. See *Kunkel de Arte Vitrariâ*, where you will find a delineation of the Furnace.

Modern yellow Arſenic.

If the arſenical Flowers of Cobalt be flux'd with a tenth part of common Sulphur, the yellow poiſonous Arſenic will be produc'd, which ought to be carefully diſtinguiſh'd from Orpiment; for it kills paſt remedy.

Modern red Arſenic.

When the like Flowers of Cobalt are flux'd with a fifth of common Sulphur, it is the modern red poiſonous Arſenic, which, for the foregoing reaſons, ſhould alſo be well diſtinguiſh'd from the Arſenic of the Ancients.

It appears then that the modern Arſenic has little of Sulphur; but contains ſomething very ſingular and peculiar in its nature, which the Ancients were unacquainted with, of moſt deadly effect to all kinds of animals, and not eaſily referable to any ſort of known Bodies, ſeemingly however approaching rather to Sulphurs than to any others; on which ſcore I have clap'd it among them. See *Hofm. Obſ. Phyſ. Chem.* throughout.

Liquid foſſile Sulphur, Petroleum.

Thoſe pinguious liquors that iſſue out of the earth are very much of the nature of Sulphurs, ſince it is of them that they chiefly conſiſt. *Petroleum*, whoſe name beſpeaks what it is, is of this ſort. It is expreſſed from *Bitumen* in fuſion; trickles out of Rocks, and is very thin, light liquid, of an offenſive ſmell; it is totally inflammable, and is frequently found floating on the ſurface of Springs; it reſembles a diſtill'd Oil in ſo many particulars, that many will have it to be thrown up by ſubterraneous fire. This is often called *Bitumen*, tho' it differs from it in colour, ſmell, and tranſparency.

Naptha.

Naptha is really very like *Petroleum*, but more dilute, thin and white; 'tis exceedingly inflammable, burning a conſiderable while, and ſcarce capable of being extinguiſh'd; it is the pureſt and moſt ſubtile part or *Flos* of *Bitumen*.

Bitumen.

Bitumen in *Latin*, and *Aſphaltum* in *Greek*, is thicker than *Naptha* and *Petroleum*; very clammy, yet apt enough to run. It is commonly found on the ſurface of Water in its natural ſtate, and it burns with great violence.

Pix Judaica.

Pix Judaica or *Bitumen Judaicum* is the ſame ſubſtance, which dried and hardened either by Fire, or the heat of the Sun, or Time, becomes dry and harder than Pitch, being ſhining and heavy. In this ſtate it is fuſible by the heat of the Fire, and will mix with any oleous ſubſtance.

Piſaſphaltum.

Piſaſphaltum in the meaning of the word ſignifies ſomething between Pitch and *Bitumen*; it is black, earthy, and of an unpleaſant ſcent; and ſeems to differ only in degree from the former. It may be perhaps a natural or artificial conception of various fatty ſubſtances, with a native *Bitumen*.

Gagates. The ſame ſubſtance wrought up to ſuch perfection as to become intenſely black, hard, earthy, fit to be cut, poliſh'd, of an unpleaſant ſmell, and ſhining, ſeems to form the *Lapis Gagates*, *Thracius Nicandri*, or Jett.

Lithanthrax. But when the pinguious parts of *Bitumen* chance to be mix'd up and concreted with ſtony Glebes, or elſe probably with metalline *Scoriæ*, and ſo form a hard, flaky, laminated, black, pinguious, cleavable and inflammable ſubſtance, it ſeems to produce the *Lithanthrax*, or foſſile Coal, which therefore I include in this claſs.

Amber. Amber, *Carabe*, *Succinum*, *Electrum* comes into this liſt, and ſeems to be of the tribe of Sulphurs, as it burns and flows in the Fire. It conſiſts of an acid liquid Salt, and alſo of one that concretes it into Glebes, and gives it a ſolid form. Moreover, it participates of an Oil very like *Petroleum*. This is white, grey, lemon-colour'd, yellow, black and red.

Oil of Earth. Oil of Earth of the *Indies*, as deſcribed by *Neuhovius*, we ſeldom ſee any thing of it, it being kept up for the uſe of the petty Princes of *Aſia*. I know not for certain whether it be a ſpecies of *Petroleum* or *Naptha*.

That which comes to us under this name from *India*, in the way of merchandiſe, is the Oil of the Cocoa-Nutt mix'd up with medicated Earths, as I was inform'd by a perſon well ſkilled in ſuch matters, and ſo ſhould be rank'd among vegetable Oils. *Quære*, Whether the *Barbadian* Oil be not prepared in the ſame manner.

Of Stones.

Stone. A Stone is a hard Foſſil, not ductile, but frangible, fix'd in the Fire, and ſcarce fuſible by any degree of heat, or diſſoluble in Water.

Which marks evidently diſtinguiſh it from Metal, Salt and Sulphur.

They may conveniently be divided into pellucid, ſemi-pellucid and opaque.

Gemm. Pellucid Stones may properly enough be called Gemms, as the name of the *Genus*.

They ſeem to be neareſt the nature of Glaſs; though they exceed it in hardneſs, ſolidity, ſimplicity, and difficulty of fuſion by Fire; 'tis not improbably a very delicate and intimate commixture of the moſt perfect Salt and Earth, as ſaline Aſhes fixt in the fire makes Glaſs.

A tranſparent Gemm, without the leaſt teint or colour, bears a very ſtrict ſimilitude of Glaſs.

The white, clean, pure Cryſtal, that will melt Glaſs, and ſcarcely run in the Fire, bearing a near reſemblance to Glaſs, and form'd by a certain juxta-poſition and concourſe of *Radij* and *Strata*, ſeems to claim the firſt place in this Claſs.

The true Diamond, is the moſt pure, hard, ſolid, clear, refulgent, and precious of Gemms, and probaby comes the neareſt to a perfect Cryſtal, exceeding all other bodies in its particular manner of refracting light; and enduring the utmoſt force of Fire for any length of time without harm.

Baſtard-Diamonds of the beſt ſort come very near the Diamond, but are ſofter, leſs ſolid, and leſs pellucid.

The white Saphire is much of a nature with the Diamond; as likewiſe the oriental Amethiſt, whether made colourleſs by Nature or Art.

The Topaz alſo and Chryſolite, when deprived of their colours, have the reſemblance of the Diamond.

The true *Aſtroites*, which in the ſun-ſhine throws out a briſk light radiating from one certain point, belongs to the claſs of Pellucids.

The value of theſe conſiſts in their degrees of hardneſs, ſolidity, and pellucidneſs.

Gems that beſides being pellucid, are tinged with ſome beautiful colour, ſeem to have been formed of the ſame kind of matter with the former, but to have received their teint from ſome metalline or other fixt foſſile admixture at the time of their formation; this appears probable from a ſimilitude of colours, as well as from the compoſition of artificial Gems. The moſt noted of them are,

The Amethiſt, the Berill, the Carbuncle, the Chryſolite, the Granate, the Hyacinth, the Opal, the Ruby, the Saphire, the Emerald, and the Topaz. Nor ſhould the coloured Cryſtal be excluded from this tribe.

The value of theſe conſiſts in their extraordinary hardneſs, ſolidity, purity, and beauty of teint.

There is a ſort between opaque Stones and Gems, which may properly enough be named ſemi-opaque, and they ſeem to be of a more compound Nature than thoſe I have mentioned; the chief of theſe are,

The Agate, Sand, one ſort of the *Aſtroites*, the *Armenius verus*, the Toad-ſtone, the Cornelian, the Chalcedony, the Heliotrope, or true oriental Jaſper, the Jaſper, the true *Lapis Lazuli*, the *Lapis Nephriticus*, the *Leucopthalmus*, the *Malachites*, the *Onyx*, the *Sardius*, the *Sardonyx*, the *Selenitis*, and the *Turcois*.

Theſe are eſteemed according to their ſolidity, hardneſs, tranſparency, and beauty of colour.

The opaque ſort are the *Ætites*, Alabaſter, *Amianthus*, *Belemnites*, *Gypſum*, *Hæmatites*, *Jaſpis*, *Lapis Judaicus*, *Lapis Lydius* or Touch-ſtone, Magnet, white, grey, yellow, brown, black, porphyrian, red, and green Marble, the *Ophites*, *Oſteocolla*, Pumice, Lime-ſtone, Whet-ſtone, Mill-ſtone, Flint, *Specularis*, Emeril, Talk, and Tripoli.

Theſe laſt are very various in their natures, ſome of them will ſoon run to glaſs, and others remain a fixt calx in the moſt intenſe fire.

Earths.

Foſſile and native Earths, are generally of a pinguious texture, inſomuch that with water they may be made into a kind of paſte, being uſually call'd Boles, but they are not diſſolvable either by water or fire. Of theſe are Argill, *Axungia Terræ* or *Lunæ*, *Cimolia*, Fuller's-earth, white *Armenian*, *Chian*, *Etrerian*, *Lemnian*, yellow *Maltan*, red ruddle, *Samian* and *Selinuſian* Boles, all the *Terræ Sigillatæ*, and the *Tocavienſis*.

Some are of a more marcid nature, as white Chalk, Marle and Ochre.

PART II.

Of Semi-Metals.

The Articles of the ſeventh Claſs, are ſuch bodies as contain real or known Metals in them, or ſubſtances of ſo near akin to Metals, that they be in a manner taken for them, and are even rankt among them by Writers of good repute. Theſe, eſpecially the more ſimple of them, are reducible to the three *Species* following.

1. Semi-Metals, conſiſting of a real Metal, and an additional Salt.

Vitriol. Theſe are called *Atramentum Sutorium*, Calcanth, and Vitriol.

They are divided into two ſorts; one that is from Iron, of a greeniſh colour; another from Copper which is generally of a pleaſing blue. It ſcarce appears, that any of the other Metals undergo a diſſolution in Mines; and this becauſe their proper ſolvents, acid Spirits of Nitre, or Spirit of Sea Salt, do not occur there; ſo that the diſſolved or concreted Juices of Gold, Silver, Mercury, Lead and Tin, are very rarely or not at all to be met with.

Yet 'tis paſt diſpute that the metalline part of Lead may be diſſolved by a gentle acid, though it be afterwards with difficulty brought to cryſtallize, as Chemiſtry will eaſily evince; for it is apt preſently to turn to Ceruſs upon the removal of the acid, and the ſame holds good of Tin.

Every vitriolic Foſſil therefore that we have hitherto any knowledge of, is either from Iron or Copper.

Yet 'tis not impoſſible, that the ſmaller parts or duſt of other Metals may mix with Vitriol in its ſtate of ſolution, and ſo be concreted with it; but that the other Metals may be equally diſſolved by the ſame ſolvent, and intimately united with them, does not appear. Spirit or Oil of Vitriol ſeparated by a violent fire, is a ſolvent both of Iron and Copper: and the like liquid may be artificially obtained from Allum, or from the fumes of kindled Sulphur.

Moreover Vitriols and Sulphur are form'd, increas'd, and brought forward in the ſame *Matrix*. The *Pyrites* is taken out of the Earth, expos'd to the Air, freed from its copious Sulphur, bruiſed ſmall, diſſolv'd in Water, and ſuffer'd to cryſtallize about wooden Sticks.

Vitriol may be alſo obtained directly from the *Miſy* of the Ancients, by a bare natural Solution and Cryſtallization.

Whence Vitriol is of five ſorts. 1. The green, which is from Iron and Spirit of Sulphur alone, being celebrated for its medicinal qualities, and for making the beſt Ink. 2. That inclining to a blew, which conſiſts chiefly of Iron, with a ſmaller portion of Copper diſſolv'd by Spirit of Sulphur. If this ſort be diſſolv'd in Water, and iron plates are ſteep'd therein, it tinges them of a copper Colour, which ſhews that it has ſome admixture of Copper. 3. White Vitriol, which ſeems to differ but little from the true green, and is owing perhaps to an increas'd degree of Heat, which plainly appears in the factitious Sort; it is the ſame with the green in all other reſpects. 4. *Chalcites*, the true *Calcanthum*, or red Vitriol, is alſo much the ſame with the green, and is reſolvable into the very ſame principles; it holds perhaps a ſmall portion of Copper, but its compoſition ſeems chiefly to be

Iron and the Acid of Sulphur. 5. *Cyprian* or *Hungarian* Vitriol which is perfectly blew, and is entirely from Copper, and the ſame acid liquor of Sulphur. The *Sory* which is exceeding ſharp, hard, coarſe, pinguious and glebous, ſeems to be a concreted juice of Vitriol, of a cineritious or black Colour; ſo that Vitriol may ariſe from a mere Water.

Alſo the *Melenteria*, which is cineritious, or black, glebous, and cauſtic, is a production of the ſame nature and origin.

Now the Baſis of all theſe is Iron and Copper, and the diſſolvent Juice is an acid Spirit of Sulphur; but it is a water diluting the acid, and ranging the metalline Particles in a certain order, that gives them their Figure and Tranſparency. And according as the proportions of theſe three Ingredients are diverſified, the ſeveral kinds of Vitriol ariſe, as the Ancients have obſerved.

Therefore the Vitriols which we call Native, are formed of Water, an acid Spirit of Sulphur, and the Metals of Iron and Copper, mixt together and united in a certain proportion.

Sulphureous Semi-metals.

2. Other Semi-metals conſiſt of a Sulphur and a Metal blended together, and of theſe the chief are,

Native Cinnabar, which is prepared in Mines from the union of Sulphur and Mercury by ſubterraneous Fire: This is illuſtrated by the manner of making artificial Cinnabar, or the *Minium* of the Ancients. It is eaſily reſolvable into real Sulphur and Mercury: Hence we learn that real Sulphur is copiouſly generated in Mines by the ſole work of nature.

The *Stibium* of the Ancients, the ϛίμμι of the *Greeks*, and the Antimony of the Moderns is compounded of a real foſſile Sulphur, and a ſubſtance very like a Metal; to which if Malleability could be added, it would have a real metalline nature, and make a ſeventh ductile Metal. But we are hitherto unacquainted with any ſuch way of purifying *Stibium*. And yet the great Mr. *Boyle* mentions a real fluid Mercury to have been ſeparated from it by Art; and every novice and vain pretender is ready enough to give his word for the poſſibility of the thing. It is fuſible in the Fire, and makes a notable flux for other foſſile ſubſtances.

But as it is brittle in its own nature, ſo it deſtroys the Malleability of the metalline Subſtances it is mixt with.

And there is ſcarce any Body ſo fixt in the fire but it renders wholly or in part volatile, when it is put in fuſion therewith.

It enhances the orient complexion of Gold in a very extraordinary manner.

And laſtly it ſeems to partake much of the nature of white Arſenic.

Biſmuthum, *Biſemutum*, Biſmuth, is like *Stibium*, conſiſting of lamellated Fibres; it reſembles Silver in its white luſtre; it is ſcarce friable, but hard; it wants Malleability, and ſhews many marks of Sulphur. With Acids it lets fall a bituminous ſediment; it is not fixt in the fire like Metals, but it renders them volatile and brittle when mixt with them.

Zinetum, Zink, is very like the former, but leſs friable.

3. All cryſtalline, ſtony, and earthly Foſſils which hold any portion of real Metal, may be claſs'd among Semi-metals; and there is hardly any Metals whoſe veins do not yield plenty of theſe ſubſtances. Theſe that follow are of chief note:

The *Lapis Armenus*, *Cyaneus* and *Lazuli*, which laſt is a ſlight mixture of a blew ſpangled with golden ſpots. It is ſaid to contain a good deal of real Gold.

The *Lapis Hæmatites*, which appears to be richly fraught with a Metal much like Iron; when it is ſublimed with Sal-ammoniac, it ſmells ſtrong of an aromatic Sulphur: Whence ſome call it *Aroph*, or *Aroma Philoſophorum.*

The Magnet, or Loadſtone; which holds a ſympathy with Iron, and is almoſt of its colour and nature.

Ochre is in all probability of the ſame tribe, as it ſeems to be a precipitation from chalybeate Waters.

Now from all this we may pretty well point out the principles of Foſſils, which ſeem to be chiefly reducible to Mercury, metalline Sulphurs, Salts, combuſtible Sulphurs, Earth and Stones. But they are very much diverſified in particulars, as will appear upon a careful examination. A volatile ſaline Acid is what ſeems to be the moſt active among them, tho' in ſome caſes Fire alone is the principle of Motion.

Of Vegetables.

Plants in general.

Among the things which fall under the notice of Chemiſtry, thoſe of the Vegetable or Plant kind come next in order.

A Plant is a moiſt Body containing various juices in different Veſſels, part of whoſe ſurface adheres to ſome other Body, from which it draws in the matter of its nouriſhment and increaſe.

Hence 'tis evident how much it differs from Foſſils, both in the variety of its ſolid containing parts, and the fluid parts it contains; and likewiſe in its manner of being made up of Solids and Fluids.

That external part of a Vegetable called the Root, which draws in its nutriment from the Body it is connected with, does likewiſe ſufficiently diſtinguiſh it from any Animal that has been hitherto known.

The ſolid parts of Vegetables are a mere Earth, faſtened together by ſuch a tenacious Oil or *Gluten* as nothing but an open fire will deſtroy.

The Veſſels of Vegetables differ not only in their make and poſition, but alſo with regard to their contents and virtues.

Their Roots.

The office of the Root is to fix the Plant in the ſoil where it grows, or to attract in its nouriſhment, which laſt indeed is the main end of it; and for that reaſon the whole Surface of ſome Plants is employed in this function, as in the Muſhroom, or Puff.

The nutritious Juice is imbibed through certain pores which are ranged copiouſly and in a due order, over the whole Surface, whence it is convey'd through proper Canals, and diſtributed throughout the whole Body of the Plant. Theſe Veſſels may be very juſtly compared to the Lacteals of the Meſentery, and the other abſorbent Veins of an Animal.

However the Juice, upon its being receiv'd into theſe Veſſels, does not immediately take on the proper nature of the Plant, nay it retains its former crude quality. But be it Earth, as it is for the moſt part, or Water that adminiſters this *Pabulum*, thither it will be ſure to return again ſome time or other; ſince nothing that takes its riſe from them, can after having gone through its ſeveral changes, avoid being diſſipated in the Air, or deſcending downwards to the Earth or Water; and that part too which the Air receives, will after a ſhort time re-viſit the bowels of the Earth, or the channels of the Sea in the form of Dew, Miſt, Snow, Hail, Hoar-froſt, or Rain. So true is it that the Earth is the *Chaos* of all paſt, preſent, and future Bodies, from whence they all aroſe, and to which they muſt certainly return.

Water, Spirits, Oils, Salts, and all others are repoſited in the Earth, where they are agitated by ſubterraneous, artificial, and celeſtial Fire; become mixt with Water, and invelop the Roots of Plants that penetrate the Surface.

The Water of the Sea, of Rivers, and of Lakes, receives like the Earth, the particles that deſcend from the Air, whilſt it, as it were, elixiviates and waſhes other particles out of the Earth.

And from hence ariſes that extraordinary quantity of crude, ſour, watery Juices which are thrown up in Plants by a briſk motion in the Spring-ſeaſon: Which we may learn from the liquor received in veſſels from the bleeding Birch, Walnut, and Vine in the month of March.

The Structure of the Plant undergoes a continual alteration from the celeſtial and terreſtrial Fire, the Elaſticity of the Air, the Viciſſitudes of Moiſture, and Drought, Cold and Heat, Day and Night, and the Seaſons of the Year. Thus the Juice by being protruded through various organs, becomes gradually aſſimilated from the ſeveral coctions it undergoes, to the true and proper nature of the Plant itſelf.

The buſineſs of the Leaves is from the make of their veſſels, their number, and their ſubſtance, to expoſe as it were to the air the Juices that are chiefly in motion, to the end that their Superficies being thus increas'd in proportion to their Matter, it may the more eaſily act upon them, and effect the alterations neceſſary to the new natures with which they ought to return back into the plant. *Malphigi* endeavours to ſhew, that they are analogous to the lungs in an Animal. **Leaves.**

The Leaves have their proper humours, as a melleous liquid that is ſpread over their ſurface in the Summer-nights, an exſuding Wax, Manna, and the *Thereniabin* or Manna of the Eaſt; which having been acted upon and concocted by the heat of the Sun, and afterwards condens'd by the cold of the enſuing night, may be gather'd in plenty.

The Cupps, *Petala* or Leaves, Stalks, and *Apices* bring the liquors thus prepared in the Leaves, to a further maturation, and impreſs on them the natural Characteriſtick of the Plant, and fit them by the ſeveral alterations they make in them, for the nouriſhment of a new *Embrio*. Indeed the affinity and cloſe ſituation between the Flowers and the Leaves, the riſe of the Gems or Buds, and the ſtructure of the Flowers when in perfection, ſhould reaſonably induce us to think ſo. **Flowers.**

Here it is that the ſweet and as it were vital *Aura*, which the ripened Flowers diffuſe, and which ſo highly regales the Senſes, is generated, being of a nature perfectly agreeable to the *Embrio*. This is ſo delicate, as to loſe all its fine ſcent, by the leaſt admixture of any other ſubſtance.

Here likewiſe grows the true Honey, which as it exſudes, diſtills into ſmall receivers at the bottom of the *Petala*. This the bees ſuck in, and then diſcharge it into their combs, and ſecure it in them with wax.

Wax is alſo found on the *Apices* of the Stems, as well as on the Leaves; which the bees ſcrape off with their rough feet, and forming it into a roundiſh lump, load it on the hinder part of their bodies, and ſo bear it away to their hives; and with this they build and ſeal up their combs.

The Seed. The Fruit is the Receptacle which includes the Seed; and the Seed is the *Embrio* of a Plant, with a ſingle, double or manifold *Placenta uterina*, or *Cotyledon*, to which the *Embrio* is faſtned by an umbilical Cord. The *Cotyledons* are commonly moiſtened by a balſam with which their cells are filled, and which ſeems to have been elaborated to the higheſt degree of any of the juices of the Plant. It is oleous and tenacious, and by keeping out other liquors, defends the *Embrio*, and at the ſame time by its tenacity arreſts and retains the fine pure volatile Spirit, which finiſhes the whole buſineſs of action in the Plant. The Alchemiſts call it *Spiritus Rector*, *Archæus*, and the ſervant of Nature.

This Oil is never obſerved to enter the veſſels of the *Embrio*, which are too fine to receive ſo viſcous a liquor. 'Tis likely that the Spirit enlivened with a vegete power, inſpires the vital principle into the aliment of the *Embrio*, and impreſſes on it the ſtamp of its peculiar tribe, from whence it is afterwards communicated to the ſeveral parts of the Plant; and it is this alone which ſeems to retain ſuch an efficacy; for when the Spirit is deſtroyed, the Oil that remains is found to be inactive, and vapid. In this Spirit the fragrant ſmell, and particular taſte of the plant do reſide, and the colour of it too depends in a great meaſure upon it. *Iſaacus Hollandus* gives it the name of *Quinta Eſſentia.*

But the fibres of Plants, which are of a dry and brittle nature, do require an Oil wherewith to moiſten them, ſo that they may bend without breaking. And this is another ſort of Oil which we find in Plants, being contained in particular veſſels, which are diſtributed among their woody filaments. It may be diſcerned in the wood itſelf, and diſtills from it by heat in the form of a balm or reſin, which differs according to the degree of warmth and the length of time employed in ſeparating it.

Bark. The Oil of Plants being concocted, and rendered leſs perſpirable than the reſt of the humours, by the heat of ſummer, is turned into Bark, through which a ſet of *Lacunæ* are diſſeminated, that contain a pinguious ſubſtance, like the *Membrana adipoſa* in Animals. In theſe cells it begins to take up its reſidence during the cooler part of autumn, and with a ſort of fatty veſtment defends the whole body of the Plant againſt the winter's cold, and the acceſs of watery particles. It partakes of an acid Spirit, which is a continual antidote againſt Putrefaction. The whole value of many of the *Aſiatic* and *Indian* Plants, conſiſts entirely in this cortical Oil. Thus the Cinnamon of *Aſia* contains an Oil in its Bark more pretious than Gold, and the Bark of its root affords that wonderful medicated liquor, which from its ſmell is wrongly called Oil of Camphire. The Bark of the *American* Saſſafras abounds with a noble pinguious liquid. And that of the medicated Plants of *Europe*, does for the moſt part poſſeſs the greateſt ſhare of their vertues; as the Capper, the Tamariſc, the Aſh, and alſo that celebrated Febrifuge the *Quinquina* of *America*. Now the Bark chiefly abounds with theſe Oils in the winter ſeaſon. In the ſummer and ſpring-time the other aqueous, ſaponaceous, and ſaline juices, penetrate the Bark in their paſſage into the air, and then it is that quite different contents are diſcovered in this part by Chemical Trials, than at other times. When the proper native Oil of the Bark is collected, it is liquid; when it has continued there ſome time, by being inſpiſſated from the rays of the Sun, it acquires the conſiſtence of a balſam, and changes its name. If it ſtays yet longer, under a more intenſe degree of heat, it becomes ſtill thicker, and as it were ſemi-reſinous. And the ſame cauſes either encreaſing or continuing, it takes the name and nature of a perfect reſin, which being diveſted of its acid Spirits is totally combuſtible, melts at the fire, is diſſolvable in Oil and mixes with it, will not be dilated with water, hardens with cold, loſes its oleous tenacity and becomes friable. This reſin being ſtill further concocted grows ſtill harder, and is named Colophony. The Bark has another juice called Gum, which is tough, tenacious, liquefiable by heat, and combuſtible in fire, tenacious in cold, unleſs it be very ſevere, but entirely diſſoluble in water. This oleous Mucilage covers and ſecures the Gems of trees after the manner of a paint, but is eaſily diſlodged thence by moiſt warm weather, never offending the tender ſtems with too hard a cruſt.

When it ſo happens that the Gum is mixt with the reſin about the Bark, as it frequently is in umbelliferous Plants, what they call a Gummi-reſinous juice is formed, one part of which eaſily diſſolving in water, ſets forth the nature of a Gum, and the other readily mixing with Oil, and refuſing to be diſſolved by water, beſpeaks a reſin. The Aloe, Galbanum, Myrrh, and ſeveral others have this property.

Proper Juice.

Laſtly every Plant has a Juice which peculiarly belongs to itſelf, and to no other Plant: This is the reſult of the whole powers of the ſeveral parts of the Plant applied ſucceſſively to the crude Juice which it received in: From ſuch a preparation it acquires the real property of the Plant as well as the vertue. It can ſcarce juſtly be referred to any claſs of known beings, but it deſerves to be regarded as ſomething very extraordinary.

If you examine with a Microſcope a ſmall leaf of the *Chelidonium majus*, growing upon the live Plant, you will perceive that a number of fibres do ariſe from its ſtalk, which are diſperſed all over its ſurface, and that their ramifications do inoſculate with one another in the likeneſs of net-work, with a wonderful variety, occupying as it were the whole area of the leaf. Wherever you make a puncture in one of theſe little nerves, a copious yellow Juice will iſſue out of the orifice, poſſeſſing the real vertues of its Plant. So in the common Aloe, during the ſpring, a pale yellow Juice of a bitter taſte runs through certain veſſels, and may artificially be obtained from them.

Pure *Opium* in like manner drops from the wounded Poppy, in the likeneſs of milk. Now if theſe Juices are mixt with other Juices of their reſpective Plants, there ariſes from their union a quite different taſte from that which they had when ſeparate.

Theſe particulars, Gentlemen, I judged it proper to lay before you from the hiſtory of Vegetables, before I acquainted you with the manner of treating them by a chemical Management; and what I have ſaid I think may ſuffice. You may hereby diſcern what vanity thoſe Chemiſts indulge themſelves in, who take upon them to demonſtrate that ſuch and ſuch particular ſeparate parts, do poſſeſs the intire power and vertue that the Plant is endued with. They muſt call in other Arts to their aſſiſtance, or elſe they will not only miſs of their end, but be the promoters of error. I may venture to ſay, with reverence to ſome authors of note, that the particular texture, and the medicinal quality reſulting from it, is ſo altered in every Plant by diſtillation, fermentation, putrefaction, and calcination, that it will require a very cautious procedure to be able to pronounce any thing about the cauſe of their actions. Yet does not this diminiſh a jot the worth of the ſcience, nay it ſhould be a motive of purſuing it the more eagerly, ſince 'tis it alone that can determine what it is, which by a proper manner of operation can poſſibly be obtained from any body, and of itſelf point out to thoſe who endeavour at putting it daily in practice, the errors they may at any time fall into. On theſe two accounts it muſt needs be extremely beneficial, and within this compaſs, 'tis capable of conducting us in a multitude of noble purpoſes.

The *Spiritus Rector*, the Oil wherein this Spirit really reſides, a neutral Salt, a fixt or volatile alkaline Salt, an Oil mixt with a Salt in the manner of a ſoap, and a ſaponaceous Juice ariſing from ſuch a mixture, an Oil very tenaciouſly adhering to an Earth, and very difficultly ſeparable from it, and laſtly a real Earth, the ſolid baſis of all the reſt, are the particulars which a chaſte Chemiſtry has ſeparated from Plants, and ſhewn to reſide in them.

Of Animals.

The Animal Kingdom, as 'tis called, conſtitutes the third ſett of Bodies which fall under a chemical Inquiry. But as it is the bodies only of Animals that it is concern'd about, without meddling with any other principle belonging to them; we are to underſtand that nothing but their bodies and the ſeveral parts of them are here meant. Wherefore an Animal may be defined, a moiſt body continued alive by a conſtant and determinate motion of humours through veſſels, and which contains veſſels within it like roots, through which it takes in its food and nouriſhment.

The veſſels which in this caſe perform the function of roots, occur in every known ſpecies of Animals, being ſituated chiefly in the *Fiſtula inteſtinalis*, and are called lacteal and meſenteric veins. Theſe take in the matter of nutriment from the meat and drink that is applied to their orifices, and which is analgous to the Earth applied to Plants. So that the internal concave ſurface of the mouth, gullet, ſtomach and inteſtines do bring the nouriſhment to all Animals; and the difference is, that Plants admit it in through their external, and Animals through their internal roots. The Earth which nouriſhes the Plant is always external to it, and that which nouriſhes the Animal is ever internal. And this holds good even in thoſe kinds of living creatures, which by nature are fixt and grow to another ſolid Body. As in Muſſels, Oyſters and the reſt of the *Zoophytes*, whoſe ſhells are fixt to pieces of timber, or rocks, and yet connected by a ſort of *Callus* with the Animal they contain. As lon as the Animal lives, its teſtaceous covering grows and receives nouriſhment from the Body within it, whilſt the included and fixt Animal lets in its nouriſhment at its mouth, which is afterwards applied to the natural ſurface of the Inteſtines, as in other Animals that move with freedom which way ſoever they pleaſe.

Moreover the Fœtus's of oviparous Animals which have their reſidence in the ſhell, till ſuch time as by a proper warmth and the nouriſhment received from the white, they are looſened from the yolk, and become ſtrong enough to break out of their priſon: and finally thoſe whoſe eggs are repoſited in the *Uterus* of the female, and are there nouriſhed by means of *Cotyledons* or a *Placenta*, and fixt to an umbilical cord; and under this circumſtance of adhering to ſuch *Cotylėdons*, *Placenta*, umbilical cord, or *omphalo-hepatic* veſſels, reſemble a plant, do notwithſtanding, as ſoon as they are removed out of the *Amnion*, convey their nouriſhment through the mouth to the Inteſtines, and ſo ſupport themſelves in all reſpects as other Animals.

Hence we are inſtructed, not only in what Plants and Animals reſemble each other, but alſo wherein they differ.

And likewiſe, as ſome Plants grow in a fixt ſoil, others in running water, and a third ſort in both; ſo Zoographers do remark, that ſome Animals are inhabitants of the Earth, others of the Water, and a third ſort of both.

Laſtly, as Plants by their open veſſels take in from the Air, the humours which are applied to them, ſo alſo do Animals.

Now we cannot but be ſenſible of the great agreement between them, if we conſider, that they are both ſupported by the very ſame aliment. As Plants ſubſiſt by the Juice they draw in from the Earth, ſo are Animals fed by Vegetables, or the parts of other Animals which were themſelves firſt nouriſht by Vegetables. Therefore the matter of both muſt be alike.

And as the crude Moiſture which roots receive from the Earth, does not immediately put on a vegetable nature; ſo neither does Food, nor the Chyle which is made from it, immediately take on the complexion of the Animal it feeds, but retains for ſome time the diſpoſition of the thing from whence it came.

So that from the texture of an animal body, and a union with the already concocted humours, the food puts on an amazing variety of forms, and conſtitutes new *Species* in every part of the Body, which ſhall be taken notice of elſewhere: Suffice it to our preſent purpoſe to obſerve, that it departs the more from its priſtine nature, as it takes up longer time in being conveyed to the ſeveral parts of the Body, and is united and diluted with a greater number of fluids.

Spirit in Animals.

The exceeding ſubtile part of animal humours is called the exhaling Spirit, wherein a certain peculiar power ſeems to be exerted, which perfectly diſtinguiſhes one thing from any other: This is very conſpicuous in Hounds, who are able infallibly to ſingle out that particular creature among a whole herd, which they have purſued a mighty diſtance, and by a confuſed courſe, barely by the ſcent which they remember to have ariſen from its footſteps; nor are they at all at a loſs to diſcover their maſter in a croud by the ſame means: Whence it appears, not only how exceedingly delicate theſe vapours muſt be, but that they are likewiſe of a diſtinct nature from every thing elſe. They ſeem to be of an oily Origin, or at leaſt to be contained in an oleous vehicle, as the analogy of things compared with the other properties ſeem to indicate.

Water. Water, as it enters into many Compoſitions, ſo does it very copiouſly into the humours of Animals; nay, it is ſo intimately blended with all, even the ſolid parts of them, that as Chemiſtry aſſures us, there is ſcarce any to be found that is entirely deſtitute of it.

And Salt. They have a Salt, which is proper to the Animal, beſides thoſe they take in with their food, which the Body is incapable of altering.

Not the leaſt quantity of a fixt Salt is ever found in them.

Nor can any be diſcovered ſo volatile, as to exhale from the Body by the greateſt heat it is ever affected with in a ſtate of health.

It may be totally rendered volatile and carried away by any degree of Fire exceeding that which is requiſite to make Water boil. It is never obſerved to contain any thing of acidity, unleſs it had been introduced into the Body with the food.

Nor has it by any trial been found to be alkalious either in healthy or diſeaſed Animals: I have examined Urine that through an Iſchury had been retained five days in the bladder, but could not diſcern the leaſt portion of Alkali therein.

Yet does Urine become entirely alkalious by putrefaction, or an intenſe Fire. But when by a careful management it is conſolidated into glebes or lumps upon committing it to ſteady reſt after evaporation; a Salt is thereby formed which differs from every ſpecies of known Salts; and though it approaches the neareſt to Sal-Ammoniac, yet does it widely differ from it in ſome of its properties. For Sal-Ammoniac may be totally ſublimed without alteration by a ſtrong heat. Whereas this, which by Fire is obtained from Urine, the true *Lixivium* of Animal Salt, becomes all at once entirely alkalious.

Whoſoever ſhall proceed in a ſeries of Experiments, in order to diſcover the true nature of the Salt of Animals, ſuch as it is in a healthful ſtate, will find it to be of a mild ſaponaceous nature, being united with an Oil; that it is a mean between a volatile and a fixt one, that it has no mark either of Acid or Alkali, and that it is eaſily reſolvable into a fœtid volatile Oil, and an alkalious volatile Salt, for which reaſon it is very liable to putrefaction.

And leſt any one may be miſled from calcined Urine's leaving any fixt Salt, it may be proper to remark, that if ſuch a Salt be found, it is Sea Salt, which was taken into the Body, and which none of its powers were able to alter; it remaining the ſame after having paſt through the ſeveral Digeſtions.

And it is to the ſame cauſe, that the very ſmall portion of an Acid, which may be obtained from human blood by a careful management and an intenſe Fire, is owing; for it cannot be imagined to be any other than the acid Spirit of Sea Salt mixt with Earth, and ſeparated by the violence of Heat.

It is obſervable, that thoſe Animals which take in no Sea Salt with their food, have not the leaſt quantity of fixt Salt in their Urine, nor of Acid in their blood.

Oils of Animals.

Animal Oils appear, upon a chemical Examination, to be very various. For ſome of them are ſo ſubtile as to mix with Water, and to be raiſed by a moderate Fire, reſembling in this reſpect the Spirits of Vegetables, yet theſe latter being produced by Fermentation, they widely differ from them.

Again, ſome animal Oils ſeem to be of a perfectly mild nature without the leaſt Admixture of Salts, whoſe uſe is to lubricate the ſolid parts of the Body. This pinguious ſubſtance is congeſted in the hollow of the bones, and is called Marrow, and in the *Membrana adipoſa* where it takes the name of Fat, it lying in readineſs in theſe parts, always to anſwer the purpoſe for which it was deſigned; it ſerves to correct the acrid Moiſture of the Body, and is ſometimes found floating upon the blood.

There is a third ſort of this Oil, which being blended with the Salts of Animals, is of uſe to the Body, as it thereby puts on a ſaponaceous quality. This, when ſeparated, is found to be of a different nature from the reſt; being more acrid, fœtid, and volatile.

There is another ſort which connects the Elements of the conſiſtent parts together, yet ſo as to preſerve a requiſite flexibility: This was originally united with the terrene Elements, nor can it but with great difficulty be ſeparated from them, and that too by the force of a violent Fire, or by the continued action of Air, Water, or Heat, inducing putrefaction, and then a volatile Oil is obtained, and nothing but mouldering Aſhes left behind. This Oil is eaſily diſtinguiſhable by its extreme fætid Scent.

And laſtly, there is a certain wonderful Oil to be ſeparated from the inſpiſſated humours of Animals by the long continued action of a moſt violent Fire, which is called *Phoſphorus*. It abounds with a ſubſtance ſpontaneouſly inflammable in open Air, which entirely conſumes, leaving behind it a fixt, acid liquor.

Earth of Animals.

Finally, Earth is lookt upon as the Baſis of the whole Body, ſerving to the connecting, and confining of the ſeveral humours thereof.

This Earth differs in little or nothing from the true Earth of Vegetables; for when we examine it perfectly clear'd of all other ſubſtances, we ſhall be ſure to find it of the ſame nature in both. Of which truth the Teſts and Furnaces uſually employ'd in examining Metals, do afford a very notable inſtance. Theſe are conſtructed of one ſimple matter, which is a very ſimple Earth that will neither melt, nor vitrify in the Fire. And it makes no difference whether this matter be the pure Earth of burnt Vegetables or Animals, carefully ſeparated from their Aſhes according to Art, that of either equally anſwering the purpoſe, nor do they differ from each other in any one ſenſible quality. Theſe are the Elements which we find to concur in the contexture of animal Bodies; and theſe, and theſe only, has Art made us acquainted with.

What Chemical Elements in them.

It were a vain thing to expect that theſe Elements ſhould be taken ſeparately, and ſo artfully re-united as to exhibit the natural Humours from whence they were produced. A quite different compoſition would reſult from ſuch a mixture; for in every part of each Animal, Humours are found of ſo ſingular a nature, that they always ſeem intimately of a diſtinct kind from all the reſt. The bitter Bile is confin'd to one only place, and the hepatic Bile to another. The Seed is elaborated and brought to perfection but in one part, and the *Spiritus motores* are wrought up in another. The Chyle of the Stomach, of the Inteſtines, of the Meſentery, of the *Ductus chyliferus*, of the *Vena cava*, of the Heart, of the Lungs, and of the Arteries, is of a different nature, in all thoſe ſeveral parts; to ſay nothing of the Milk, Fat, Lymph, Serum, *Saliva*, Blood, Urine, and other Liquors that ariſe from it.

From what has been ſaid, it appears how great a concurrence there is between the Elements of Animals and of Plants: the former being made up as it were entirely of the matter of the latter; and that the chief difference between them conſiſts in the variety of their ſtructure, and the more rapid Motion with which the aliment of Animals is carried through their Veſſels.

Let it ſuffice that I have laid down theſe few particulars concerning the Object of Chemiſtry.

Actions of Chemiſtry.

Chemiſtry is concerned in the examination of the ſeveral Bodies which conſtitute the three Claſſes before mentioned. The alteration which the Art cauſes them to undergo, is the reſult of Motion: To which effect either a new Motion muſt be excited, or one that is already in being, ſuppreſs'd, or changed in degree, or put into a new direction. Theſe Viciſſitudes may ſometimes obtain, tho' the whole Maſs remains the ſame that it was before; and oftentimes the ſeveral Particles which conſtitute the whole Maſs may ſuffer more Alterations one among another. Upon theſe very ſimple actions do the various effects of the whole Art of Chemiſtry depend, altho' millions of new and wonderful forms reſult from the diverſity and multitude of the Particles of Bodies. Upon a ſtrict enquiry it will be found that they can ariſe no other way, and that the Art can refer them to no other Origin. Let us only take into conſideration one corporeal Maſs. If it be entirely at reſt, if all its Particles are at reſt among one another, as they were in the beginning, would not ſuch a Body continue for ever immutably the ſame? Now apply the Art of Chemiſtry to it, and ſee if it will not leave it as it found it, unleſs it can contrive to communicate ſome Motion, either to the whole Maſs, or to ſome of the parts of it? Suppoſe again Motion to be in ſuch a manner impreſs'd upon the whole Maſs, as to tranſlate it out of the place it is in, to another, without altering the ſituation of any of its parts with reſpect to one another; in ſuch a caſe the Body wou'd undergo no kind of Alteration but that of being removed from place to place every moment: But if a new Motion ſhould be excited among the parts, it is eaſy to conceive, that an infinite variety of things might ariſe from it. Therefore the whole buſineſs of Chemiſtry is to unite, or to ſeparate; nor is there any third Province allotted to it: So that all the Operations that it performs are without exception reducible to theſe two. Nor ſhould the ſimplicity thereof abate of the eſteem it deſerves, as if it were impoſſible that it ſhould be productive of ſuch a multitude of various and amazing effects, not to be expected from any other quarter; ſince it is now a matter paſt diſpute that all the wonderful diverſities that we are capable of contemplating in any Compound, are no other than the *Phænomena* which neceſſarily flow from the ſimple mechanical application of different things. That from a few Elements of Bodies, an innumerable ſeries of new Bodies may ariſe, the Doctrine of Arithmetical Combinations plainly evinces. And finally by the application of one thing to another, the latent qualities of Bodies are frequently diſcovered. If a Loadſtone had never been placed ſo near to another Loadſtone, as to be within its Sphere of Attraction, ſuch a thing as the magnetical Vertue had not been to this day ſo much as gueſs'd at; and if Iron had never come into the circumſtance of contact with the ſame Stone, that particular and amazing property between it and the Magnet had been a thing utterly unknown to us; laſtly, if Iron toucht by the Magnet, had never been apply'd to another piece of Iron, whether toucht or not toucht therewith, what man alive would have ever dreamt of thoſe conceal'd faculties, by which ſuch odd Motions are brought about? From the Hiſtory of *Menſtruums* it appears, that many of ſuch Bodies are indued with a kind of reciprocal Powers, which do not in the leaſt diſcover themſelves but upon a very cloſe Approximation, but do then very evidently affect our ſenſes. Whence it is paſt diſpute plain, that by a reſolution of Compounds into their Simples, and a various Combination of thoſe Simples, infinite new Productions may reſult.

Conſequence of bare Alteration of Figure.

If we conſider one ſmall Maſs alone, which undergoes an Alteration, and yet retains exactly the ſame quantity of Matter: In ſuch a caſe it is only the Figure that is chang'd, or the Surface that is varied; and yet may this ſimple Alteration be immediately productive of new Powers in it. This may be illuſtrated from mechanic Arts; as when from the ſame Steel, only by a change of Figure, inſtruments are made which have diverſe powers of acting. Suppoſe a piece of Steel of half an ounce weight to be faſhion'd into a wedge, a knife, a ſtilletto, a lancet, a ſphere, a cube, a cylinder, a priſm, a pyramid, or a cone, will not each of theſe have new Powers, peculiar to itſelf?

All which ſhews that the ſimplicity of chemical Actions, is no reaſon why they ſhould not bring about an infinite variety of effects.

Chemical Separation does not exhibit parts as they exiſted before.

It were of excellent advantage to be appriz'd of this truth; for a prejudice commonly prevails among Chemiſts, that there is really ſomething of myſtery in their Art. But upon a cloſe ſcrutiny into their capital Operations, what I have advanc'd will evidently appear. Calcination, Fixation, Vitrification, Sublimation, Fermentation, Digeſtion, Depuration, Unition, and the reſt of them are reducible to one ſingle Conſideration.

However a ſeparation of parts ſo effected, does not demonſtrate that the parts did exiſt ſuch in the Body as they now appear to be; for ſince theſe corpuſcles may undergo amazing varieties of Alteration from the very Actions themſelves by which they are ſeparated from one another, it were a wrong way of concluding, to pronounce that the Compounds did poſſeſs theſe very Elements.

But new Powers of acting take place in the particles thus divided, which were never in the leaſt manifeſted by any effect, in the Body from whence they were taken; which an infinity of Examples ſhew us.

On both which accounts it is plain how much thoſe Chemiſts muſt be miſtaken, who fancy they can by Art exhibit their firſt Elements of things, and then ſhew what judgment ought to be form'd of Compounds, by the parts ſeparated from them by chemical Operations.

Phyſical Atoms

Upon a ſtrict Contemplation of things, it is evident to demonſtration, that there are ſome Corpuſcles which conſider'd ſeparate and by themſelves no cauſe did ever produce any Alteration in. Whether the Author of things has beſtowed on them a hardneſs ſo much exceeding that of a Diamond, ſo that they are not to be divided into particles of a leſſer ſize or alter'd in their figures, or that he originally form'd them ſo very ſubtile, as to eſcape the Powers of Action of all others.

As often therefore as in attempting a Reſolution of Compounds, the Diviſion has proceeded to theſe minute Elements, there is an abſolute ſtop to all farther Diviſion, till theſe ſimple particles come again into Combination with other ſimple ones, or with ſuch as are compounded.

Hardly diſcoverable by Chemiſtry,

Such Principles the Philoſophers have called the Elements of Bodies: And into them the Chemiſts have frequently aſſerted that Compounds may be reſolv'd. But they themſelves confute their own Opinion. For as they muſt grant that the Elements of Fire, Air, Water, Earth, *Alochol* of Wine, Mercury, the *Spiritus Rectores* in every body, and other Spirits conſider'd as abſolutely ſimple, are conſtant and exceedingly minute, ſo muſt they acknowledge it to be a matter of uncertainty, whether ſuch ſimple parts can ever be confin'd and ſenſibly exhibited by any Art: In the vulgar operations of Chemiſtry at leaſt, it has been a long time paſt diſpute, that no ſuch thing is done.

Whoſe Productions are rarely ſimple;

Fire is perhaps the only thing that will give its Elements pure, when it is paſs'd through Gold, or the like Subſtances. But who will pretend to offer ſo much as a ſingle drop of perfectly ſimple Water? Much leſs can any one pretend to produce any of the reſt in a ſimple ſtate. It were needleſs to mention Air, Earth, *&c.*

Moreover from thoſe very parts into which the greateſt Artiſts boaſt that they have reſolved Bodies, parts of a different nature and eaſily changeable may be again produc'd; as the Water, Spirit, Salt, Oil, and Earth ſeparated from animal or vegetable Bodies do ſhew; even *Alochol,* in burning alters its nature.

Nor does the ſame Compound ariſe from them.

Finally, if we regard them as re-compounded. It is very ſeldom that the chemical Elements of any Compound, will upon being reunited make the ſame Compound as the former. This is ſhewn from the Analyſis of Blood, Wine, and other Bodies.

It

The Concluſion from a chemical Analyſis.

It behoves us therefore to fix certain limits to our Art, and always to confine our ſelves within them, to the end that truth may be diſcovered, and errors of every kind avoided. The Operations of Chemiſtry are capable of producing from animal, vegetable, and foſſile Subſtances, effects that are determinate, and accurately diſtinguiſhable by their ſigns. But whether they did really exiſt ſuch as they appear to be, in the Compound before any Operation was performed thereon, is not ſo eaſily decided, without the help of other arguments.

Alochol of Wine, by proper Fermentation, and exact Diſtillation, is with certainty produc'd from Vegetables, always in the ſame manner and of the ſame nature: Nor has it hitherto been found poſſible to obtain it from any other Subſtance; and even from this it cannot be done, but by repeating the Operation. But this Liquor which the Chemiſt procures, was no where to be found before a due Fermentation and Diſtillation were called into his aſſiſtance; and therefore who beſides the Chemiſt is able to pronounce any thing concerning its Matter, Cauſe, Nature and Virtues? That this truth obtains with regard to moſt Bodies, we are very certain. And therefore we confine the Art to narrow bounds, yet we are for maintaining that it is the more worthy, excellent, uſeful, and neceſſary, on this very account.

What the Spiritus Rector in Compounds is, according to the Alchemiſts.

Thus we are aſſured by this Art alone, that there is in every particular Animal or Vegetable, a certain *Halitus* proper to that Body only; that it is of ſo ſubtile a nature, as only to manifeſt itſelf by its ſmell, or its taſte, or by ſome effects peculiar to it. This vapour expreſſes the *Genius* of its Body, by which it is accurately diſtinguiſhed from all others. Beſides the exceeding minuteneſs of its parts, entirely eſcaping the notice of the eyes or hands, it is endued with a moſt perfect Volatility. It has no ſooner obtained its purity and ſimplicity, but it flies off, and mixes with the Air, and ſo returns into the common *Chaos* of all volatile Bodies. Yet there, tenacious of its Nature, it continues to float about, till it falls in Moiſture with ſnow, hail, rain, or dew, to the earth, and ſinking into its bowels impregnates it with its own prolific vertue, and then re-aſcends with its humours into the Juices of Animals and Vegetables, and by ſuch a ſort of revolution, enters into and influences new Bodies. The ancient Alchemiſts, who were indeed the ſupreme Maſters of the Art, and moſt qualified enquirers into phyſical truths, called this liquor, from its mobility, penetrability, exquiſite ſubtlety, and efficacious volatility, *Spiritus Rector*.

Its Seat in the Oil.

That this Spirit might remain fixt in its Body, *God-Almighty* blended it, not with Air, or Water, or natural Fire, as being liable to be eaſily diſſipated, but with a tenacious permanent Oil; that ſo being reſtrained by its Viſcoſity, it might not readily fly away, and utterly deſert the Body it was deſigned to occupy. On which ſcore it is, that theſe authors are apt to cry out, that it reſides in the Sulphur.

But is more volatile than that.

Again, that Oil which retains the Spirit, is much more volatile than any other pinguious ſubſtance in the Body; inſomuch that when the Body is haſtening to death, it paſſes entirely off as it were with the breath; leſt a ſubſtance fitted for ſo many noble purpoſes, ſhould remain idle and inactive in a carcaſs.

Finally,

An exceeding ſmall quantity of the Spirit therein. Yet very active.

Finally, nature is ſo ſparing in the portion that it allows of this Spirit, that it has beſtowed but a very ſmall particle of it to each Body, and yet is that fully ſufficient. The ancient Adepts preſumed to aſſign the quantity of it, and ſo tell us that it amounts to no more than $\frac{1}{8200}$ part of its ſeminal Body, which they ſay is the conſtant proportion.

They add that it is amaſingly active, and that when it is cheriſht by a pregnant warmth, and ſupported by proper *Pabulum*, it exerts an extraordinary and wonderful motion, and acquires new Powers whereby it produces a like offspring, as daily experience evinces. For this reaſon they have given it the names of the Vital Spark, The Son of the Sun, *Spiritus intus alens*, and many more of the like ſort.

An Inſtance of a wonderful thing.

Before I proceed any further, I chooſe to illuſtrate this whole matter by one ſingle Example. Let us take ſuch a vegetable Body as may be evidently diſtinguiſhed by its marks from any other known Body whatever. Let it be Cinnamon, the nobleſt of all Aromatics, of a very fragrant ſcent, and ſweet taſte, far excelling all others the moſt valuable of their tribe. If a pound of the beſt ſort of it be diſtilled with boiling Water by the help of Fire, in a careful and artificial manner, taking heed that no part of it eſcape, a liquor will come over which is milky, odorous, and well-taſted, having at the bottom a ſmall quantity of very fragrant red Oil, rich in all the vertues of Cinnamon, as alſo was the firſt liquor with which it aſcended. When you have ſo ſeparated the two liquors beforementioned, boil up the remaining Cinnamon with more Water, and then there will diſtil a clear watery liquor of an acid taſte, a weak ſmell, not only deſtitute of all the marks of Cinnamon, but even ſo like many other things, as not to be diſtinguiſhed from them. If you examine the remainder of the laſt decoction, you will find it of a browniſh red, of an auſtere acid taſte, without any ſmell, or the leaſt token of Cinnamon. Although you would ſwear by the outward form and appearance of the aromatic Body left in the decoction, that it was fine freſh Cinnamon, and yet has it nothing beſides its figure, of all the properties it poſſeſſed: Not differing ſenſibly from any other bark or wood treated in the like manner.

Therefore the peculiar vertue muſt be entirely in the diſtilled water of Cinnamon, and the Oil that ſinks to its bottom. But if this water be committed to reſt for a conſiderable time in a cloſe Veſſel, it will depoſit more Oil, look leſs milky, and loſe much of its aromatic ſmell. This noble faculty muſt be therefore chiefly inherent in the Oil. If you ſeparate all this aromatiſed Water from its Oil, and put it into a veſſel with a ſlender neck uncorkt, the whole room will ſmell of Cinnamon, and the water will ſoon become vapid, and loſe all its fine ſpicy flavour; yet will you not find it to be more diminiſhed in weight, than the ſame quantity of common water would be in the ſame circumſtances, by Exhalation. Hence that noble power which was communicated to the Water, muſt have been confined to no more than a mere particle, though its efficacy were ſo great. Laſtly, expoſe the Oil of Cinnamon in a wide open glaſs to the Air, and the place will be moſt gratefully ſcented with the ſmell of Cinnamon, as any one will immediately perceive; yet will all the ſingular vertue of this Oil ſoon vaniſh, although it remain very nearly the ſame in weight.

We are hereby convinced, that the whole peculiar inherent vertue of the Aromatic, is united with this ſmall quantity of Oil, and that it makes but a very ſmall part even of that. This particular demonſtration may be applied to almoſt all the reſt.

The Spiritus Rector in Metals and other Bodies.

The more happy Sages of this Art do not ſcruple to aſſure us, that they have ſeen theſe Spirits in Metals themſelves, ſealed up in their proper Body, and confined by a fixt Sulphur: but that when they were ſet at liberty, they were exceeding active, and readily penetrated the ſubſtances of other Bodies, being of wonderful efficacy in the cure of Diſeaſes. I ſhall ſay no more on this head, but refer you for the reſt, to the Writings of the Adepts, leſt I may be ſuſpected of fondly recommending a thing of which I have but an imperfect knowledge.

Claſſes of Chemical Productions.

The Chemiſts have digeſted the Effects of their Art into four principal Claſſes of things which are produc'd by uniting or ſeparating. When they reſolve any one Body into the diſtinct parts which they obtain from it, and exhibit them ſeparately, they call this kind of Action by the name of Extraction. As when from Wormwood they ſeparate a penetrating Bitter, they call it the Extract of Wormwood, and the moſt active part of Iron, ſeparated by Art from the reſt of its Body, every where carries the Title of *Extractum Martis.* To this belong ſeveral Operations which are perform'd upon the ſame Body, as Diſtillation with Water, or without it; Decoction, and the ſeveral degrees of Inſpiſſation ariſing from it; Tinctures made by *Menſtruums* of any kind, *&c.*

But when from a Mixture of ſeveral Bodies put together, an Extract is drawn, as was ſaid before of a ſingle Body, they then alter its Appellation and call it *Clyſſus.* And the ſame word alſo ſignifies ſeveral different Extracts drawn from the ſame Body, and afterwards mixt together in one, as when the Water, Spirit, Oil, Salt, and Tincture of Wormwood are ſeparately obtained, and afterwards according to Art united into a compound Maſs poſſeſſing all their ſeveral vertues. To this may be referred many various and beautiful Productions of the Art, as artificial Soaps, *&c.*

Magiſtery ſeems to be a name given by the moſt ſkilful Artiſts, to that which they eſteemed the Maſter-piece of their Art. Any ſimple Body, ſay they, may be changed into a Maſs very different from its former one, and which is for the moſt part liquid, without any loſs of its parts, or alteration in its weight. Thus they tell us that they can diſſolve an ounce of Gold into a Liquid of that weight without the admixture of any other thing, but juſt as the Fire cauſes it to flow. Which if it be poſſible is undoubtedly a moſt noble Art, but hitherto wrapt up in obſcurity; unleſs ſuch a thing may be ſaid to be done by the Efficacy of Fire. It muſt be confeſs'd that Wax forc'd over the Helm by Heat, undergoes one amazing Alteration, without any Separation of its Parts.

They were wont by the word Elixir to ſignify the new Form which ſeveral Bodies, retaining their former Weight, put on upon being mixt together, thus producing a ſort of compound Magiſtery. This *Paracelſus* ſays he perform'd with Aloës, Saffron, and Myrrh. *Helmont* blames him for concealing his wonderful Solvent, without much mending the matter himſelf. But why ſhould not Art furniſh us with ſuch? The *Tartarus Tartariſatus* in a manner does the thing, bating a few *Exuviæ* of the Saffron; and doubtleſs, other people may have diſcovered far better: 'Tis no ill rule to rate and eſteem our neighbour's Qualifications by our own Defects; tho' 'tis true enough that Artiſts are a little too much given to boaſting.

I am not in the leaſt ignorant that ſome Authors have affixt quite other Meanings to the Terms I have been explaining, but I here deliver the Interpretations of thoſe of the firſt Note. Every one may make what uſe thereof he pleaſes.

Of the End of the Art in Natural Philoſophy.

Uſe of Chemiſtry in Natural Philoſophy, as it makes uſe of Fire, and as it diſcovers things conceal'd,

Chemiſtry being employ'd in the Examination of all Bodies that fall under the notice of the ſenſes, it muſt be of ſervice to Phyſics in general, and takes place in all its Branches.

And firſt as it employs Fire in changing Bodies; that being the moſt general Inſtrument made uſe of by Nature in almoſt all its Operations on Bodies. But Natural Philoſophy being the knowledge of Bodies that exiſt, and of the ſeveral Modes which can be obſerved in them, Chemiſtry cannot but greatly promote it. Permit me a little to illuſtrate this Matter: It is the buſineſs of a Natural Philoſopher to diſcover an accurate knowledge of created Bodies, and of their ſeveral Affections. This Science cannot be obtained, unleſs the Senſes obſerve every thing which the Creator made cognizable to them. The firſt and principal Part therefore of it, is to collect together all the *Phænomena* of things which have manifeſtly occurr'd to the Senſes, and to digeſt them into a natural Hiſtory. Now there is a twofold way of laying in a ſtock of Obſervations. Firſt by taking them in as they caſually offer themſelves, without any ſort of deſign or inquiry. But Art can receive no great matter of benefit from hence, ſince it is nothing but mere chance, that now and then preſents us with one or a few Properties, and no more. The other Method is, by induſtriouſly comparing Bodies after a previous Circumſpection, with other well-known Bodies, to the intent that the Mind may conſider of the Reſult. And that ſuch a way of proceeding muſt be of great ſervice to Natural Philoſophy, appears from this alone, not to inſiſt any farther, that an infinite number of efficacious Properties do obtain in Bodies, which we ſhould have never had the leaſt notice of from the common Information of Nature, but are only manifeſted to us when the Bodies to which they belong are examin'd, whether by uniting or ſeparating, according to the Rules of Chemiſtry, whoſe principal inſtrument is Fire; and this with a view of being able to diſcover the Event. This laſt Part ſeems to be almoſt entirely the Province of Chemiſtry, which reſolves Compounds into their ſimple Parts, and again re-unites the Parts, to the intent of diſcovering what new Appearance will ariſe, and what new Powers will

not only by taking notice of ſuch things as offer themſelves ſpontaneouſly, but by carefully making Experiments on purpoſe.

Indeed more than any other Art,

be the conſequence of ſuch Trial. By ſeparating or uniting things of various kinds, having a ſtrict regard and attention to the degree of Fire, it curiouſly ſcrutinizes into Nature's Deſign: And having thus obtain'd a knowledge of her Modes of acting, it accurately imitates her *Phænomena*, and ſets in view the real Inſtruments with which ſhe works, and treading with prudence in her ſecret Paths, often happily arrives at the End it propoſed. Gun-powder, *Phoſphorus*, Liquors which grow hot upon mixing, and break out into flames, to paſs by an infinite number beſides, are Examples of what I have ſaid. It muſt be allow'd, that perſons well vers'd in Mechanics, Hydroſtatics, and Hydraulics, have by an infallible method happily explain'd many phyſical Actions from the general and univerſal Properties of Bodies. But who among them was ever able to diſcover thoſe Effects of Bodies which really depend upon a particular Nature, proper only to ſome certain ones, which the CREATOR was pleas'd to impreſs on them, and whoſe Effects had never exiſted, without ſome particular forces had exiſted in the particular Bodies. When a Magnet is apply'd to another Magnet, or the ſame Stone to Iron, what odd and peculiar Effects do they produce as often as they come within the Sphere of each other's Attraction? Now Chemiſtry above all other Arts is capable of diſcovering and explaining the Cauſes of theſe *Phænomena*, by a proper manner of adapting Bodies to that end. We ſee then that Chemiſtry bids faireſt for promoting the Knowledge of Nature, it being the fitteſt Inſtrument we can employ therein. And whoever is a Maſter of it, may perform ſuch Effects as are the conſequence of a right Knowledge of Nature, without having recourſe to ſubtile Language or idle Speculations, ſince the very thoughts of ſuch an Artiſt tend directly to Effects. He that explains the Nature of Glaſs, ſhews at the ſame time, how it is to be made; and he that accounts for Fermentation ſhews how to produce it. His words are facts. He performs his taſk by a proper application of Bodies to Bodies, without invoking Dæmons, Hobgoblings, or Ghoſts. He minds not the Names of ſubſtantial forms, but the Powers that occur to the ſenſes, and obtain in every particular Body, which being of peculiar kinds, he from thence deduces Events, and then applies them to ſurprizing Purpoſe. He calls in no occult Qualities, but roots out the Effects which he finds too fondly aſcribed to them, and ſhews what Operations are to be inſtituted about them. He owns that the Creation of Seeds, and the peculiar Texture of every Body are matters he is unacquainted with, yet is he a diligent Obſerver of the *Phænomena* which ariſe from them, and a prudent Applier of them to the changes that are to be produc'd in things. Such are the fruits of a well-order'd Chemiſtry in Natural Philoſophy, by which ſuch a Science will be eſtabliſht, as was markt out by the noble Lord *Verulam*, and carried on upon the beautiful plan of that great Maſter, by the immortal Mr. *Robert Boyle*.

as appears by Examples.

PART II.

The Uſe of Chemiſtry in Medicine.

The very great Uſe of Chemiſtry in Medicine, in ſhewing the Nature of Firmneſs

Medicine is of no leſs moment than Natural Philoſophy, as it takes into conſideration the human Body, and the Effects of other Bodies thereon. Yet were it impoſſible to acquire a competent Knowledge either of the one or the other, without the Aſſiſtance of Chemiſtry. I think it very needleſs to produce many arguments for this Aſſertion. Chemiſtry alone inſtructs us that the firm Parts of our Bodies are made up of Elements merely terreſtrial, conglutinated by an Oil not to be ſeparated from them but by the force of an open Fire. And the ſame Art informs us, that ſome portion of Water is interſpers'd among the ſame Parts, which likewiſe by being conſolidated therewith, performs the office of a *Vinculum*, and is difficultly diſunited from them. It alſo demonſtrates that ſuch Earth, Oil, and Water ariſes from the Aliments, and that the Humours of the Body alſo have their Original from the Food, a thing unknown before Chemiſtry ſet it in a juſt light.

and Moiſture.

Nor is it poſſible to give any tolerable account of the Parts, Kinds, Powers, and Changes of theſe Humours without the ſame help. As there is a particular and conſtant degree of Heat requiſite to a ſtate of perfect Health, which we are taught to meaſure by the Thermometer; the Knowledge of which is a certain and infallible Guide for eſtimating the Power of its Action; Chemiſtry has certainly the beſt pretence to explain the Effects of this Fire.

And as Mechanics, Hydroſtatics and Hydraulics do point out many of thoſe particulars which are eſſential to the State and Preſervation of Health, no leſs than the other parts of Natural Philoſophy, ſo does Chemiſtry enrich the mind with many natural Truths which were before inſcrutable to it. Upon the whole it muſt be confeſs'd that a great number of things of moment occur in the phyſiological part of Medicine, of which we never ſhou'd have had the leaſt Knowledge but by Chemiſtry. But the great Glory it has to boaſt of is, that it is capable of diſcovering and removing the Errors which Pretenders to Chemiſtry have introduc'd into Medicine, which *Boyle*, *Bohn*, *Hoffman*, and *Homberg*, beſides others, have ſufficiently proved by extraordinary inſtances. Such idle Artiſts were out of doubt widely in the wrong in pretending by Chemiſtry to explicate all the *Phænomena* of Nature; but are they leſs ſo who pretend to do the like without any of its aſſiſtance? Anatomy may give a juſt account of the Parts and Structure of the Body; Mechanics may conſider the Situation and Motion of the Solids; and Hydraulics the Action of the Fluids in their ſeveral Canals: In ſhort, let us be furniſh'd with as much Knowledge as Induſtry can ſupply, yet in my Opinion after all, it will be found that a juſt Idea of medical Phyſiology will be obtained from the genuine Doctrine of the Chemiſts only.

Corrects its own Errors.

And aſſiſts Pathology.

Nor does Chemiſtry according to my judgment contribute leſs to completing a perfect *Pathology*; for can the Cauſes, Modes and Effects of Humours degenerating in our Bodies be properly explained without it? It is impoſſible to have any notion of the manner the Juices are vitiated, by a Stagnation, or too ſlow Motion, in the Veſſels, or by ſtanding ſtill in a ſtate of Extravaſation; or how the Oils, Salts, Spirits and Earths which float in our liquors are changed by too quick a circulation, without learning it from our Art. You may endeavour in vain to diſcover what Acrimony is, of how many kinds, how it affects our Bodies, and from whence it ariſes, unleſs by this way of enquiry, which will eaſily explain the whole matter. And in the like manner may the effects of *Pus*, *Ichor*, *Sanies*, a virulent Juice, a putrid Gangrene and a Sphacelus be diſcovered: And out of this road I dare confidently pronounce, that after all your pains you ſhall meet with nothing ſatisfactory. Without a chemical Contemplation you will find yourſelf at a loſs to trace even the Maladies of the Bones, and explain them from their real cauſes.

Semiotice.

But allowing that Chemiſtry is of particular ſervice to *Phyſiology* and *Pathology*, yet ſay ſome, how can it with any ſhew of reaſon be introduced into *Semiotice*; or the Art that points out the ſigns of Health, and of Diſeaſes, an Art cultivated and improved to the utmoſt perfection by the ancient *Greeks?* It muſt be confeſſed indeed that they exerciſed a ſomething more than human accuracy and diligence in collecting the diagnoſtics of Diſeaſes. And yet it cannot be denied, that their whole pains were employed only in noting down thoſe things which nature ſpontaneouſly offered to the Senſes. And this they did with ſuch exactneſs, that they left no room for poſterity to improve upon them. Nay it behoves a Chemiſt to build his foundation on them, before he employs his own Art about the knowledge of diſeaſes; and to allow them at leaſt what is due to their Wiſdom. But to underſtand, what every mark or ſymptom really ſignifies, will be found to be no eaſy matter, without having recourſe to our Art, which will then be perfectly underſtood. I could, if leiſure would permit, give particular inſtances of this matter. A quick pulſation of the Arteries, the Ancients were ſatisfied, denoted a Fever, the degree of which, they taught, was to be eſtimated from the number of ſtrokes in a given time; and that by an increaſe of the natural heat, the radical moiſture was conſumed, and that according to a greater or leſs degree of this increaſe, Life was more or leſs in danger. And Dr. *Harvey* has told us, that a quick pulſation is to be aſcribed to the heart's taking in, more frequently than uſual, the vital blood from the veins, and forcing it out again into the Arteries. The uſe of this obſervation went no further. But a Chemiſt enters deeper into the matter, and tells us, from a due compariſon of Experiments, that when the pulſe is quick, and the heat augmented, the more liquid parts are then exhaled away, and the reſt rendered denſer; that the Oils are diſſolved, and in this ſtate mix with the blood, and by attrition become acrid, volatile, and putrid, and getting into the fine veſſels of the Brain, incommode it in a wonderful manner; it being a matter of great difficulty to expel them out of the blood, when they have once got a footing there; and that the ſaline part of the humours is ſo altered, that from its natural liſtleſſneſs to motion it is now rendered volatile, and has exchanged its mild for a corroſive nature, being in this new ſtate a ſharp cauſtic Alkali, whereas it was mild and ſaponaceous before: thus is the ſign not only underſtood, but the genuine uſe thereof is alſo laid down. It was a uſual thing among the ancient Phyſicians, to deduce the internal ſtate of the body in Diſeaſes, from inſpecting the Urine. And the Moderns are compelled by a

Sort of neceſſity to do the like, with what uncertainty I need not ſay. But were a Phyſician thoroughly verſed in Chemiſtry to examine ſuch Urine by the rules of his Art, how many uſeful diſcoveries would he make? The quantity, colour, taſte, contents, ſcum, ſediment and froth, would afford him infallible marks of the nature of the Water, Salt, Oil, and Earth in the Urine, and conſequently in the Blood; they would therefore denote the hidden diſorders of the Humours, and ſerve for Prognoſtics of good or evil ſoon enſuing. And it is from this fountain alone, that a Phyſician can poſſibly derive the means of maſtering the preſent ſymptoms and guarding againſt future ones, ſo as to ſecure the life of his Patient. No one but a Chemiſt is qualified to judge accurately of the nature of ſpittle, ſweat, *pus*, *ichor*, or excrements by their ſigns; not that his own Art alone will help him out entirely in this point. But when to a knowledge of Medicine he adds a thorough ſkill in Chemiſtry, he is then thoroughly qualified, by the joint aſſiſtance of theſe two, to enter upon ſuch reſearches, as without them he could never have been capable of. Theſe truths I would ſeriouſly recommend to ſuch Gentlemen of the Faculty as are apt to hold Chemiſtry in a ſort of contempt, that they may be cautious of condemning an Art which may ſtand them in great ſtead, and can never do them any detriment. I own that Chemiſts not rightly inſtructed in Medicine have been pretty famous for miſchiefs when they have been hardy enough to turn Practitioners, but this is the fault of the Men, and not of the Science.

Gives Rules of Diet for healthy Perſons.

No one can lay down rules of diet for healthy perſons according to Art, who knows not what kind of corruption meat and drink put on under a certain degree of Motion of the Body of him who is to uſe it, or his particular temperature. The Bodies of running foot-men, huſbandmen, and all who uſe a laborious exerciſe, do eaſily putrify fiſh, and fleſh unſalted, from the great attrition they exert upon them; and for ſuch, ſower black Bread, Milk, Fiſh or Fleſh dried in the Air, or ſmoakt, and ſprinkled plentifully with Salt and Vinegar, with Water or ſour ſmall Beer, will be of ſervice. For here the bile and the blood, through too rapid a Motion, have a tendency to putrefaction, which therefore muſt be guarded againſt by things that are acid, ſalt, and hard, theſe being oppoſite to its nature. But to the ſtudious and contemplative, who deny themſelves a due ſhare of exerciſe, it were beſt to preſcribe things of eaſy digeſtion, that are of kin to the humours of their Bodies. And of theſe, Chemiſtry points out ſoft meats, fiſh, and eggs with very little ſalt, and pretty freſh. In a word, it is Chemiſtry that can beſt regulate and adjuſt the quantities and circumſtances of Air, Meat, Drink, and their ſeveral Ingredients and manners of Preparation, as alſo Motion, Sleep, Excretions, and Affections of the Mind, as the neceſſary inſtruments of a healthy life.

Of the greateſt uſe in Therapeutics.

But if the cure of Diſeaſes be the matter in view, whence I beſeech you would you procure a proper diet for your Patients? Or proper Medicines for their ſupport or recovery? How would you obtain for them ſuch things as are capable of correcting any thing that is foreign to the habit, or of expelling it thence? or how would you appeaſe their pains, but from proper inſtruments,

ments, which Chemiſtry alone explains, digeſts into order, and adapts to the ſeveral purpoſes? I would not be thought in the leaſt to advance any abſurdity in aſſerting, that Chemiſtry accurately traces out the ſeveral ways, by which we learn from the marks we can collect from the Patient, whether, what, and by what means we ought to act, in order to preſerve and re-eſtabliſh Life, and alleviate or entirely remove the Diſeaſe, together with its Cauſe. I would preſume, if you pleaſe, to recommend to your reading what I have written about the *Methodus Medendi*, for the uſe of young Phyſicians.

The truth which I have inſiſted upon is corroborated by the authority of the very great Lord *Verulam*, who throughout his Writings recommends Chemiſtry as a thing abſolutely neceſſary in every branch of Medicine; being convinced thereof from real experience. I might name alſo Mr. *Boyle*, who in his elaborate pieces of the ſceptical Chemiſt enlarged with his own additions, of the uncertain ſucceſs of Experiments, of ſpecific Medicines, of the hiſtory of human Blood, of the uſefulneſs of experimental Philoſophy, of the production of mechanic Qualities, and in ſeveral others of his Works, has actually demonſtrated the mighty uſe of Chemiſtry in the Art of Phyſick. Were it not needleſs to name any more after theſe? Yet if you pleaſe you may peruſe the *Engliſh* Philoſophical Tranſactions, and the Memoirs of the *French* Academy of Sciences, and there you will find how induſtriouſly this Art has been employed for the furtherance of Medicine. And the *German Ephemerides*, do every where abound with noble arguments to prove the reaſonableneſs of it. Yet it is a melancholy conſideration, that we ſeldom find Phyſicians, otherwiſe expert and well inſtructed in their Art, to have hardly any notion of Chemiſtry, or on the other hand that perſons well verſed in Chemiſtry, have any idea of Medicine, to the great misfortune of both theſe noble Arts. What Elogiums are not due to *John Bohn*, and *Frediric Hoffman*, perſons exquiſitely qualified in their Art! I omit to name *Otto Tachenius*, and *Francis de le Boe Sylvius* along with them, becauſe by a kind of raſh and blind zeal, they could hardly endure to hear Chemiſtry called the Handmaid of Medicine, but were for having her the Miſtreſs. Whatſoever is fairly deduced from Chemiſtry, and can be properly applied to Medicine, without danger of error, and to the advantage of the healing Art, I have endeavoured to collect, and to inſert under proper heads in my little book *de cognoſcendis & curandis Morbis*, and afterwards in another, *de Materie Medica.*

Its Uſe in Mechanic Arts.

Chemiſtry of ſervice to the Arts of Workmen.

The Arts which require the action of the hands, and are vulgarly called Mechanic Arts, are quite of a different nature from the ſcience called Mechanics, which ſhews the powers of Bodies from the common properties of all Bodies, and which admits of geometrical Demonſtration. Chemiſtry can be of no manner of ſervice to this latter; but it is of mighty importance to the former Arts, which are concerned in the actual management and change of Bodies.

In Painting.

The Art of Painting, which imitates and expreſſes all viſible objects in Colours, ſo as to tranſmit their images to poſterity, is of ſo noble a kind as to have been eſteemed and honoured by ſovereign Princes in all Ages. See *Junius*'s laborious work *de Pictura Veterum*. Many other Arts are indeed ſerviceable to this, but in that part of it which concerns Pigments of a requiſite beauty and duration, Chemiſtry bears away the palm, which I will ſhew in a few inſtances. The Pigment called Ultramarine is of a lovely blue unalterable by time, and this Chemiſtry alone is capable of preparing and perfectly from the *Lapis Lazuli*. Smalt, though a common blue, is a fine ſpecimen of our Art. See *Anton. Neri*. L. VII. 115. and Dr. *Merret*'s Notes upon it. Is there any colour that the beſt Painters do more earneſtly deſire to be maſters of than a fine durable green? The delicate blue of Ultramarine dearer than Gold, mixt with any fine ſtanding yellow, immediately gives them the thing they deſire. Now were it not for our Art, painting would be deſtitute of two of its moſt valuable Colours. What effect is produced in a Picture from their livelineſs and tranſparency! All which is owing to the inventions of the Chemiſts, *Neri* L. VII. 16. 120. I ſhall forbear to ſpeak of Cinnabar, Orpiment and Ochre as alſo of Bones burnt to blackneſs in a cloſe Veſſel for the Painters uſe.

In a word, though Chemiſtry be widely different from Painting in its nature, yet it would without it want its beſt ornaments; and though a Chemiſt may do well enough without the Art of Painting, yet will the Painter ever ſtand in need of Chemiſtry.

In Enamelling.

The induſtrious Chemiſts have diſcovered an Invention, by which it is practicable to incruſtate Metals, and eſpecially Gold, with beautiful Pigments, having all the ſmoothneſs of Glaſs, whoſe materials are chiefly Metals, Glaſs, and a penetrating alkaline fixt Salt. Theſe are called *Emmauſta*, *Amauſa*, *Emails*, or *Smalts*. They are extremely beautiful to the Eye, and everlaſtingly durable. Let me again refer you to *Anton. Neri* in his whole ſixth book; you won't think your time miſemployed. But above all read *Iſaacus Hollandus*, who wrote ſo beautifully about this noble Art, which may well vie with the ſuperb teſſelated Works of Antiquity; and the Necklaces and other Jewels of our modern Ladies are much indebted to this elegant Invention.

In the Art of Glaſs.

The Art of Glaſs is a thing of very great uſe to mankind. This, calling in the aſſiſtance of Poliſhment, is able to ſupply the defect of bad Eyes. What muſt an old man do with his books without it? 'Tis to this alone, that we are beholden for being defended in Houſes, Coaches, Ships, &c. from intenſe Heat and Cold, Duſt and Wind, without any diminution of the light that is requiſite to a due illumination of the Objects that are about us. Glaſs very difficultly retains filth of any kind, and when foul, 'tis cleaned again with all the eaſe imaginable. Veſſels made thereof give us a full and diſtinct view of their internal contents, and preſerve them from decay for ages, not in the leaſt affecting them, nor being affected by them. For whatever is confin'd in Glaſs perfectly cloſe on all ſides, is neither corruptible nor alterable. Glaſs withſtands the force of all Corroſives, even of the Alkaheſt itſelf, if there ever were any ſuch thing.